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# Open innovation with third parties - how to support the chemical industry

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# Affidavit

I, **CHRISTOPH HONEGGER**, hereby declare

1. that I am the sole author of the present Master's Thesis, "OPEN INNOVATION WITH THIRD PARTIES - HOW TO SUPPORT THE CHEMICAL INDUSTRY'S THESIS", 62 pages, bound, and that I have not used any source or tool other than those referenced or any other illicit aid or tool, and
2. that I have not prior to this date submitted this Master's Thesis as an examination paper in any form in Austria or abroad.

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# Abstract

The following thesis deals with the design of innovation management systems in the European chemical industry with particular focus on the aspect of open innovation. The theoretical introduction to innovation and open innovation is followed by the presentation of the basic principle of planning, control and evaluation of innovations in a business. Subsequently there will be short presentation of selected methods of innovation management, a more detailed presentation of the general success factors and obstacles as well as a presentation of the specific scopes of action and design constraints. The next part traces all the specifications that apply to the chemical industry of Central Europe. They result in the necessity of the sector to use as broad an input of impulses for innovations as possible to maintain or even develop the current competitive position. Central to the section is thus the systematic integration of initiators of impulses in the business environment, whose spectrum will be described in detail. The theoretical part is followed by empirical findings aiming at finding out in how far the statements from the research literature actually correspond to the current practice. This data have been collected in several individual and group interviews on the basis of a standard interview guide. All respondents directly or at least indirectly belong to the Swiss chemical industry sector. The survey shows that the presence of innovation management is a traditional standard in the companies. As far as open innovation regards, repeatedly, scepticism is voiced with regard to the principle and its implementation. Regulatory procedures and intentions of the lawmakers are consistently perceived as efficient barriers, opposing the implementation of the principle of open innovation. At the same time, however, collaboration with third parties and even increasing intensity of such collaboration is confirmed.

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# 1. Introduction

Recently a group of scientists headed by C. Venter, presented a spectacular innovation to the interested global public[1]. Evidently, the biochemist and his team succeeded in artificially creating life in the context of an experiment[2]. This group thus sets the course for the respective area of chemistry research for many years to come.

It is now necessary to augment the research tools of the research area by adequate and proven methods[3]. Only when these scientific practices are available, a commercial use of the results of this successful biochemical experiment can be considered. But considerable impulses have already been given by the research innovation. After all, it raises fundamental questions regarding ethical and philosophical issues; above all those concerning a suitable definition of life and the general functionality of life[4].

Sure, so far this procedure is merely a seemingly sensational experiment within a branch of chemical research. When or whether the results of the experiment will become relevant to the everyday life of broad levels of the population is unclear, because, after all, the results of this research would become more than just a milestone of avant-garde research.

At the same time, this successful experiment is able to render palpable the general economic and social impulse of the chemical sector on many advanced national economies today. For a considerable time now and almost perpetually, it has constituted the starting point for numerous revolutionising innovations, from new (composite) materials to effective drugs in the battle against previously deadly diseases. With regard to the German national economy, some researchers even ascribe the chemical industry the role of an "innovation driver" with a comprehensive effect[5].

To do justice to this role long-term, the companies in the industry are often no longer satisfied with perceiving their innovative potential exclusively as output of the respective R&D departments, because such a perspective usually limits innovations to the area of product innovations. Considering an increasingly difficult competitive environment, innovations on part of the business must be approached in a much more comprehensive manner, because any one of them has to chance to provide a valuable advantage compared to competitors[6].

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[1] Cf. **Cibson**, Daniel G. et al. (20.05.2010), Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome.
[2] Cf. **Kastilan**, Sonja (21.05.2010), Künstliches Leben.
[3] Cf. **Gehring**, Petra (26.05.2010), Das Leben im Bakterium.
[4] Cf. **Müller-Jung**, Joachim (21.05.2010), Durchbruch in Synthetischer Biologie.
[5] Cf. **ZEW/NIW** (2009), p. 1.
[6] More detailed explanations can be found in M. Mirow; cf. **Mirow**, Michael (2003), p. 331 et seqq.

Although externally one still assesses the innovative strength of numerous local businesses on the basis of "the size of their research lab"[7], a quantum leap regarding innovations has occurred from the internal perspective. Over the past twenty years, innovations have started to become a universal theme in an increasing number of businesses. Therefore, the pursuit of innovation in some sectors – including the chemical industry - has become a business principle. Analogously, many businesses have started to gear their entire organisation toward this central theme. Sometimes there even arises an enterprising innovation culture. However, the existence of such businesses is still not yet the standard but the exception[8].

At least, however, many companies begin to move innovations into the context of management behaviour. Innovation activity is systematically planned, implemented, controlled, as well as evaluated for the complete business within the framework of strategies. If done consistently, any innovation management initiates an extensive transformation which ultimately affects all areas of the business. This transformation should be considered as an ongoing process, which does not have any definitive end point. Innovation management should especially also develop and continually strengthen the ability to beneficially cater to internally relevant new trends. Such a current stream aims to transform businesses into an organisation generally open to innovative impulses from all sides.

## 1.1 Research question

At least for successful businesses, attributing the role of a provider of ideas to customers, suppliers, or even competitors does not represent a new pattern of action. However, in the meantime, rather spontaneous approaches determined by chance have developed into a methodical procedure about which different scientific concepts exist[9]. The term Open Innovation can be considered as a collective concept. In addition, the technical progress enables a radical interpretation and use of the basic concept of open innovation that would have appeared utopian a few years ago. With regard to the innovative potential of businesses it achieves the status of a second quantum leap. But this can logically only be successfully executed if innovation management already exists.

If one looks at this constellation within the context of the Central European chemical industry, the superordinate question of the present research arises: What does the general planning, control, as well as evaluation process of innovations look like for businesses from the

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[7] Cf. **Piller,** Frank/**Reichwald,** Ralf (2007), p. 175.
[8] Cf. **Stern,** Thomas/**Jaberg,** Helmut (2005), p. 22.
[9] Among the German speaking research there can be found 3 different concepts solely, cf; **Faber,** Markus J. (2008), p. 2.

chemical industry in Central Europe? And what has to be considered in particular regarding their effective further development toward an organisation open for external innovation impulses?

Of course, numerous detailed questions can be derived from the two superordinate research interests: What is meant by the term innovation? How complex must an understanding of innovation in the context of innovation management be? What turns the usual treatment of innovations into innovation management? Are innovations regarded as exclusively positive within the company or do they lead to resistances? Which success factors can be established for well-functioning innovation management? Can these be transferred to the concept of open innovation? What organisational changes are caused by such a concept? Do specific framework conditions apply to the chemical industry in Central Europe that make an application of the concept appear particularly advisable or even mandatory?

## 1.2 Procedure

The answer to the overall question is given in six parts, which at the same time constitute the main sections of the analysis. The introduction ends with a definition of the key concepts.

The second chapter focuses on innovation in a business context. It is mainly concerned with the origin, the different dimensions, the relevance, and the suitable handling of innovations within a business. After all, due to their status in many sectors, one can not avoid making innovations a matter of the top levels of management.

The third main section deals with a key aspect of the question. It is concerned with the – partially – detailed presentation of the basic principle of planning, control and evaluation of innovations in a business. It starts with the respective target development and continues with the conceptual levels of an innovation system, the fundamentals of its implementation, the possible variants of a strategic orientation and the assessment of innovations. Subsequently there will be a very short presentation of selected methods of innovation management, a more detailed presentation of the general success factors and obstacles as well as a presentation of the specific scopes of action and design constraints. The latter one shows to what extent particular frameworks conditions of individual industries and businesses contribute to a special implementation of the basic concept of innovation management.

The fourth chapter traces all the specifications that apply to the chemical industry of Central Europe. They result in the necessity of the sector to use as broad an input of impulses for innovations as possible to maintain or even develop the current competitive position. Central to the section is thus the systematic integration of initiators of impulses in the business environment, whose spectrum will be described in seven subsections. The chapter ends with

looks at new technological possibilities of such integration, at an organisation open to innovations and the resistances and risks in connection with open innovation.

## 1.3 Definition of key concepts

In particular, three terms attain a central status within the framework of the existing analysis, because around them revolve the represented contents, which is why they repeatedly appear within the text. Without precise definition of how these three terms should be understood in the paper, there is considerable room for interpretation, calling into question the significance of the result. The three terms concerned are innovation, innovation management as well as open innovation. This sequence itself represents the logical progression of a definition of the three terms since they build on each other.

No generally binding definition exists for the term innovation.[10] Not for nothing can the expression be interpreted from a philosophically art oriented perspective as well as a business perspective[11]. An economic approach regards innovation as a "conversion of a new business idea into a market success"[12]. Other authors side with this approach by viewing innovations as new, successful products[13]. However, some researchers consider new technical inventions merely as central components of innovation[14]. In this respect, these often corresponds with a traditional and at the same time more general approach to innovations, which can be described as an economic approach. It was coined by J. A. Schumpeter nearly a century ago[15]. It expands the view on new products or services by new approaches, the development of new markets and sources of supply, as well as the aspect of reorganisation[16]. Moreover J. Hauschildt and S. Salomo add a qualitative level to this rather quantitative perspective, because they emphasize that innovation is concerned with something novel and not just something new. So an additional variant can never attain the status of an innovation[17]. This exclusively appertains to new designs, ideas, products, or procedures[18].

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[10] Cf. **Abramson**, Mark A./Littman, Ian D. (2002), p. 2.
[11] Cf. **Wahren,** Heinz-Kurt (2004), p.11.
[12] Cf. **Tintelnot**, Claus (1999), p. 1.
[13] Cf. **Engel**, Dieter (2007), p. 131.
[14] Cf. **Stern**, Thomas/**Jaberg**, Helmut (2005), p. 6.
[15] Cf. **Tintelnot**, Claus (1999), p. 1.
[16] Cf. **Hübner**, Heinz (2002), p. 9; cf. **Bergmann**, Gustav/Daub, Jürgen (2006), p. 2.
[17] Cf. **Tintelnot**, Claus (1999), p. 1.
[18] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 3.

This comprehensive perspective should also be valid for the present examination, with all combination possibilities of all listed factors complete the concept of innovation in the business context, so far as their application appears to be successful or at least promising.

"Innovation management is the completion of all tasks that lead to innovative ability and thus to innovations".[19] This definition certainly reflects a very comprehensive concept of innovation management, which takes the component of innovation as a given and therefore mainly refers to that of management. However, it will likely prove to not be specific enough for further use in the context of the present examination. It thus makes sense to take up a definition from research literature.

This definition understands innovation management to be the determinative, i.e. the planned, organisation of innovation processes and the structuring of the overall environment or organisation within which these processes take place[20].

If no binding definition exists for the term innovation, then no definition can exist for the term open innovation. Especially since the expression is relatively new and is presently still in development. H. Chesbrough can be considered the inventor of the term[21]. He describes it as a model, in which businesses utilize instruments for networking with other businesses, such as development collaborations or licenses, to optimise their innovative potential[22]. In practice, for example, Proctor & Gamble, as an important market participant within the chemical industry, employs such a concept in the context of its current innovation strategy, because it aims to generate half of all novel ideas from outside the company[23].

However, some authors point to the two viewpoints regarding this opening. Accordingly, the above-mentioned definition covers only the internal perspective. The external perspective includes the creation of a platform of external exchange, that is not necessarily connected with a business, but whose input and output are available to all those who would like to participate[24]. Accordingly, non-commercial knowledge networks such as Wikipedia could also be summarised under the term of open innovation.

For the present investigation, open innovation is primarily supposed to be understood as business activity that in the area of innovation is opened to all kinds of possible sources of inspiration. Since it should thus also be open toward external knowledge networks, the abovementioned aspect is not discounted.

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[19] Cf. **Stern**, Thomas/Jaberg, Helmut (2005), p. 6.
[20] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 32.
[21] Cf. OECD (2008), p. 19.
[22] Cf. **Reichwald**, Ralf/Piller, Frank (2009), p. 147
[23] Cf. Proctor & Gamble (10.06.2010), Innovation Strategy
[24] Cf. OECD (2008), p. 20.

# 2. Innovation within the business context

The fact that the opening toward new ideas from the outside was just talked about above, combined with the fact that shortly before the general difference between new and novel was described, already shows in how much detail one has to look at the issue of innovation from a business perspective. Even if new ideas are actual innovations, the do not necessarily have to be taken up and developed for use in competition by the company receiving them. After all, innovation is here not considered as an end in itself, but rather as a central instrument for securing one's existence in a competitive environment.
At least for some businesses, impulses for innovative solutions are not hard to come by. Sometimes the expression innovation flood is even used[25]. If such a constellation exists, the right selection is vital. However, the right choice can only be made, if the innovation becomes a general subject for analytical thought and decision processes. Essential components with regard to content that decisively influence this process form the core of the following explanations.

## 2.1 The origin of innovations

If the factor of innovation comes into the focus of management activity, it is undoubtedly important to make clear from the beginning where the impulses usually originate. For example, in the chemical industry in Central Europe, for several decades, customers have been important initiators. In other sectors they can even be considered the most important ones. K. Engel estimates the share of product innovations currently initiated by customers in medicine technology to be approximately 50%.

In some cases there exist conceptually advanced impulses[26]. Usually the innovative input of the customers consists in simple demands or opinions[27]. Therefore, the idea that internal departments for research and development could be the actual drivers of innovation in a business context even today is closer to a cliché than a fact. Regardless of this, references can be found in the research literature for an apparently still too low exploitation of customers as a source for innovations[28].

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[25] Cf. **Seeger**, Stefan (2007), p. 111; sometimes even general Overload is characterized as Information; cf. **Wahren**, Heinz-Kurt (2004), p. 27.
[26] Cf. **Fichter**, Klaus (2005), p. 179.
[27] Cf. **Wahren**, Heinz-Kurt (2004), p. 26.
[28] Cf. **Engel**, Dieter (2007), p. 133.

Of course a great number of impulses for innovation still originate from the businesses themselves, i.e. internally. However, in only few cases they come from the management level and the respective ideas are also frequently not developed in the department for research and development. They rather originate from such different internal sources as employee surveys, reports by field staff, the company suggestion plan, internal market observations, and quality activities or simply from discussions among colleagues. Moreover, other businesses that have a supplier relationship to the impulse receiver also prove to be an increasingly important source for innovative ideas[29]. This circumstance allows a functional distinction of initiators into customers, suppliers as well as actual manufacturer[30].
One can also classify them according to occasions. Usually it is the aim of an innovation to "exceed the performance of an established solution"[31]. Such a performance optimization is certainly often the product of aimed efforts, but sometimes it results rather coincidentally. After all, the inventor of "Meissner" porcelain, J. F. Böttger, originally set out to produce gold[32]. Generally, errors in manufacturing processes or deviations from planned procedures such as the usual technical processes bear the potential to be the starting point for a successful innovation[33]. Likewise, changes in the current legal framework, changes in the behaviour or merely the perception of consumers, the constant change of markets or the composition of populations in individual economic systems exhibit the same potential.

That means, a well functioning company-internal innovation management develops sensors for all listed potential sources of innovations. And although it plans, aims and advances within the framework of strategies, it does not exclude chance as a possible initiator of innovations.

## 2.2 Innovation dimensions

Whatever appears novel to someone may be well-known to someone else and a third individual has been making using the apparent innovation for a long time. Regarding the classification of a tangible object or an idea as innovation, there are consequently diverging viewpoints. This circumstance provides an additional dimension to the consideration of innovations, in addition to which several others can also be identified.

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[29] Cf. **Wahren**, Heinz-Kurt (2004), p. 26.
[30] Cf. **Fichter**, Klaus (2005), p. 179.
[31] Cf. **Tintelnot**, Claus (1999), p. 2.
[32] Cf. **Figala**, Karin (1998), p. 86.
[33] Cf. **Wahren**, Heinz-Kurt (2004), p. 27.

### 2.2.1 The content-related dimension

The content-related dimension also contributes to the complexity of the approach to innovation. This dimension can be summed up by the question of what is actually new in the individual case[34]. At first glance, this question might sound obvious, but within the context of innovation management it takes centre stage, because the answer determines whether a new idea is advanced to a usable innovation. Moreover it is necessary to identify possible implications that result from its use early on, assess their relevance for the respective company and compare them. In order to be able to carry out such an assessment, first the element of novelty must be made palpable. Here, different categories for classification prove to be helpful.

A common classification also known outside innovation management differentiates product innovation and process innovation[35]. However, both areas are increasingly linked. At least in industrial operations, product innovations also frequently necessitate process innovations[36]. And in the service sector, the differentiation is not very effective since the innovations occurring there are amalgamations[37].

Furthermore, this differentiation merely refers to the technical aspect of innovation. It is not able to include innovative organisational structures or innovative business models[38].

In any case, the survey of innovation content can be expanded by a dimension by taking into account "the number and the integration of the elements of the innovative product or process"[39]. For this category, the term innovation of system properties is used[40]. It focuses on performance improvements, which lead to a qualitatively new level of achievement. For example, a previously considered utopian level of safety for the occupants of automobiles resulted from the installation of airbags. From this perspective, innovative potential arises on two different levels. First, it results from the creation of new system component. Second, the airbag example, can be transferred to other products or be applied to other areas of life. Therefore, innovative potential arises also from novel combinations of individual components to innovative system links[41].

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[34] Cf. **Hauschildt**, Jürgen (2005a), p. 26.
[35] Cf. **Bühner**, Rolf (2004), p. 196.
[36] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 9.
[37] Though this mainly represents a process innovation; cf. **Burr**, Wolfgang (2007), p. 89.
[38] Cf. **Helbig**, Tobias/Mockenhaupt, Andreas (2009), p. 7.
[39] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 10.
[40] Cf. **Helbig**, Tobias/Mockenhaupt, Andreas (2009), p. 7.
[41] Cf.**Hauschildt**, Jürgen (2005a), p. 28.

### 2.2.2 The intensity dimension

Insofar as innovations represent a distinctive competitive advantage, upon their appearance on the market all businesses must automatically ask themselves how new they really are in the individual case. That question can be used to describe the intensity dimension[42]. It has great relevance because the answer decides on the possibility of acquiring intellectual property rights or the right to imitate an innovation. At least according to the valid legal framework in Germany, an innovator is granted intellectual property rights if an invention does not fall within the realm of current state-of-the-art technology[43]. The corresponding proof results from the inability of experts to derive an invention directly from current state-of-the-art technology[44].

In short, each submitted technical invention is subjected to a review by the Patent Office, the result of which provides information about the intensity dimension or at least should. Of course, the award of intellectual property rights does not give any reliable information regarding the economic success of an innovation accepted as an invention[45]. Furthermore, approval by the patent office does not affect innovative processes or innovations of the organisation nor are such processes considered in the area of services.
Businesses which enter the market with such innovations have certain possibilities for avoiding imitation. For this they must be aware of the degree of novelty, describe it as exactly as possible and then establish qualitative hurdles which ensure that a mere copy comes to nothing[46]. No doubt manufacturers of products with every innovation face the challenge to render its novelty tangible for themselves on the basis of numerous details. However, the necessity results only secondarily from the potential intention to successfully present the innovation to the patent office. The requirement to free the novel objects from the operational routine with the help of check lists is more obvious[47].

### 2.2.3 The subjective dimension

The subjective dimension of innovation can be reflected by the question of for whom the respective object of consideration is new. After all, an innovation can objectively be novel,

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[42] Cf. **Hauschildt**, Jürgen (2005a), p. 28.
[43] Cf. PatG, §3.
[44] Cf. PatG, §4
[45] Cf. **Reichwald**, Ralf/Piller, **Frank** (2009), p. 119.
[46] In addition, in case of innovative services it is recommended to make them impervious for external observers; cf. **Busse**, Daniel (2005), p. 53.
[47] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 22.

even if the outlined classification process is required as proof[48]. But the qualitative degree of novelty is still dependent upon the perception of individuals. This perception is thus always subjective[49]. Some individuals may even unconsciously turn a blind eye to the hypothetically available novelty of a considered object. For them, it is then no innovation at all. "According to this, innovation is something that is considered to be innovative"[50]. This once again confirms the necessity to develop and employ procedures for assessing the newness of the objects under consideration since they serve the purpose of rendering objective perception. Within business organisations, the assessment of whether an object is an innovation or not is usually delegated. This means that some individuals in the respective organisation make the decision representatively for all other individuals. Perception regarding innovations is thus shifting from the individual to an institutional level. Similar to the general decision-making authority, it usually lies with the top management. The business would therefore consider innovative "what the management of a company considers innovative"[51].

One can transfer such a shift in the perception of novelties to other levels of course. For this, those of the experts, those of the respective industry, those of a national or even those of a global level could be considered. Regardless of what will actually be selected in the individual case, the perception of a novelty is always subjective. In this respect, the initially chosen definition undergoes modification. The subjective dimension changes in the following manner. Innovations firstly represent those elements which are introduced in a business for the first time[52]. If the subjective perception expands to the respective industry, one arrives at the industrial economic concept of innovation[53]. An even more extensively open perspective on the respective market or the main competitors might be of great relevance to the innovation management of a business. This is also mentioned in the research literature[54].

### 2.2.4 The procedural dimension

The external impulses for innovations in the context of medical technology, which are rather conceptually advanced, have already been discussed above. This points to the next dimension of innovation. They are not concerned with any specific process that could be compared to the refrigerator light switching on when opening the refrigerator door. Instead, the analogy of wanting to take a new meal out of the fridge would be much more fitting. In

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[48] Cf. **Braunschmidt**, Inken (2005), p. 10.
[49] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 24.
[50] Cf. **Hauschildt**, Jürgen (2005a), p. 32.
[51] **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 24.
[52] Cf. **Weber**, Christiana (2007), p. 22.
[53] Cf. **Hauschildt, Jürgen/Salomo**, Sören (2007), p. 24.
[54] Cf. **Weber**, Christiana (2007), p. 22.

this case an emerging sense of hunger indicates the need while the thought of finding something inside the refrigerator for fulfilling this need corresponds to the idea and looking at the contents of the refrigerator is analogous to research. A grasp of innovation implicitly includes a sequence of different steps. Innovations thus represent the following processes, the first step of which is always an idea or an initiative[55].

This is followed by the discovery or observation, research, in some cases discovery and development. Subsequently, two more stages follow, which constitute an important point of intersection for the innovation management within the business. The utilisation plan and the ongoing usage complete the innovation process. At same time, they contain the point at which the responsibility of innovation management necessarily ends. At least until the utilisation plan, external impulse can be integrated at each stage. The acquisition of licenses represents the motivated innovation over the development, for which a new approach begins in the purchasing business. But the question of where the exact end point of innovation management is to be set is difficult to answer and a detailed assessment has to be carried out on a case by case basis.

### 2.2.5 The normative dimension

Innovation thus represents a subjectively perceived and thus often hardly exactly understandable process that can take an extremely long time. Even the procedural dimension contains significant potential uncertainty. How can one predict the exact outcome of a development process that can take many months or even years? And this uncertainty is even more pronounced if one includes the other dimensions. Even so, the definition formulated at the beginning still contains the requirement to successfully create something novel. It alone expands the activity field of innovation management by an additional dimension, namely the normative-dimension[56].

The complexity of innovations as well as the resulting framework conditions of innovation management becomes particularly clear when one looks at the subjectiveness of success. Each individual values success differently. The assessment especially depends on the respective viewpoint of interest[57]. Ideology can also play an important role, however.

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[55] Cf. **Hauschildt**, Jürgen (2005a), p. 34.
[56] This raises the following general question: Does new equal successful? cf. **Gleich**, Ronald/**Nestle**, Volker/**Sommer**, Luise (2009), p. 190.
[57] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 28.

Practicing Catholics may not assign much of a positive value to innovations in the area of contraception and much less value them as a success. So there exists a close connection between the subjective and the normative dimension.
The general viewpoint regarding the success of innovations must also necessarily shift. It becomes more complex. The abovementioned definition therefore combines an ex-post perspective with an ex-ante perspective. Something can only be identified as successful in retrospect, while the classification as something promising success stands at the beginning of an innovation process. The practice of internal innovation management is shaped by both perspectives.

## 2.3 The status of innovations in competition

The final decision on whether an innovative attempt is a success or a failure always lies with the customer. The market is always the most important instance. Frequently enough, too optimistic assessments on the part of the companies were probably shot down by the market reality. It is therefore not surprising that the relation of economically successful to failed product innovation projects is estimated to be 1 to 7[58]. Probably even this ratio is to optimistic, as it suggests that the companies record and report all failed endeavours. But it is the nature of things to rather go public with successes than with debacles.
In at least 6 of 7 cases resources flow into innovation endeavours and at most the company gains experience as exchange value. Strictly speaking, a business approaches every endeavour with the knowledge that it will much more likely lose lots of many and time than gain a substantial monetary return. Still, the research literature assigns to innovations a central importance "for the long term survival of a company and for job security" as well as for the preservation of the assets of the owners[59]. The accuracy of this assessment is proven by the unbroken willingness of businesses to engage in innovation endeavours. Permanent technical progress is palpable evidence of this eagerness to innovate.

In turn, the enormous profit potential of successful innovations is derived from this. The profits that can be gained more than make up for all losses incurred. If it were not so, the striving of businesses for innovations would come to an abrupt standstill, because it would no longer promise a material added value. This added value is often so considerable, because an innovation principally turns the business creating it into a temporary monopoly. How long

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[58] Cf. **Reichwald**, Ralf/**Meyer**, Anton/**Engelmann**, Marc/**Walcher**, Dominik (2007), p. 15.
[59] Cf. **Disselkamp**, Marcus (2005), p. 29.

this monopoly lasts mainly depends on its competitors, although even the general development can render a novelty obsolete. In how far this competitive edge yields a financial return also depends on the achievement levels of the intensity dimension and the subjective dimension. A global innovation, for example, involves much more financial profit potential than a national innovation, given that it is widely perceived as a groundbreaking novelty.

## 2.4 The objects of innovation

So far, innovations have been primarily been related to products and/or services or to processes. Through them and with them the novel takes shape. In other words, they are objects of innovation. At the beginning the development of new markets and sources of supply as well as the aspects of re-organisation were also mentioned in passing. They could be classified as additional objects of innovation in the business context. C. Tintelnot considers central four different objects of innovation[60]. However, the development of new markets and sources of supply, for example, ideally manifest themselves in the form of superordinate strategies, the re-organisation takes place through a change in corporate structure or project structure. Similar to this Tintelnot considers strategies, products and services, processes as well as the corporate structure and project structure as the four objects of innovation in enterprises[61]. All four can be seen in isolation as well as combined. For example, the concept of open innovation is the first blueprint for a comprehensive strategy, which aims at the creation of new products and services. In order to implement the strategy of openness successfully, a change in the corporate structure is also required, which is based on novel processes.

## 2.5 Innovation as management task

"The organisation as a socio technical system and as a means of implementation of strategies and goals constitutes a central management tool for the management."[62] That means a re-organisation of a company corresponding to the concept of open innovation can only be initiated by the top executive or management levels. But even if this basic pattern of

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[60] Cf. **Tintelnot**, Claus (1999), p. 2
[61] Cf. **Tintelnot**, Claus (1999), p. 2.
[62] Cf. **Braunschweig**, Christoph/**Kindermann**, Dieter F./**Wehrlin**, Ulrich (2001), p. 306.

a strategy and even the transfer of principles of management activity are disregarded, the topic of innovation in a company is always the responsibility of its management. Because – as was already pointed at – the practical treatment of it automatically bears significant financial risks, decisions regarding which can only be made by the highest level of management. In addition, in any case, the decision of whether an object of consideration is an innovation or not is delegated to the management level of a business or appointed decision-makers within the company.

There are thus comprehensible and at the same time concrete reasons, why even traditionally the topic of innovation in the business context belongs to and must belong to the primary tasks of leadership. But only in the form of the basic concept of innovation management this operational requirement receives a theoretical corset established by business research. This foundation promoted by research allows for the ever-growing importance of innovation in a competitive environment. At the same time it also creates an approach that can be used by all enterprises.

# 3. The planning, controlling, implementation, and evaluation of innovations

Even if many companies have already established their own innovation management, there are always stragglers. In particular, however, such a pattern provides general points of orientation for entrepreneurship. Those points are based on a scientifically substantiated basis and they thus confirm the correctness of the actions of businesses which previously rather acted intuitively with regard to innovation management. In addition they are similar to benchmarks which offer the opportunity to optimise the respectively existing innovation management.

Central orientation points of innovation managements also constitute the contents of the following third chapter.

## 3.1 The generation of innovation as a business objective

From the beginning of the economic scientific discussion of the subject of innovation in the German-speaking areas it has been considered as a form of creative destruction[63]. This view implies the necessity of something existing to be destroyed for something new to develop. A broad view of innovation will certainly deny the inevitability of physical destruction. After all, one, for example, utilises new strategies without simultaneously eliminating well-tried ones. These well-tried strategies are simply no longer being used, but no physically measurable destruction takes place in such cases. Rather, a radical process takes place on a neurological level, namely the conscious renunciation of well-known processes.

These well-known processes experience a sudden loss in value and a vacuum develops. After all, at the time of an orientation toward something new there exist no experience values for it. In this respect, innovations in a business context promise competitive advantages, but striving for them can cause fear at the same time[64]. After all, what is the vague hope of the development of new markets worth compared to the sure knowledge that an already developed one will have to be abandoned?

Innovations therefore always presuppose the will to innovate. This will represent the general innovation willingness of a company[65]. However, that willingness alone will not suffice to initiate innovations in real life. A first step toward an implementation is the anchoring of innovation willingness as clearly recognisable primary business objective. This once again expresses the direct relationship of the subject of innovation and top management, because such an anchoring is the responsibility of the respective management[66]. With this step one clearly signals internally and externally the significance of innovations within the respective company.

Siemens AG, for example documents the value which it attaches to innovation based on the visionary slogan "Siemens, Global Network of Innovation"[67]. The company thus creates the foundation to be perceived as striving for innovation, especially by competitors, suppliers, customers as well as its own employees. With a clear commitment it motivates the employees to participate in the achievement of objectives[68]. In any case, it encourages all potential driving forces for innovative projects to approach the company with their ideas.

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[63] Cf. **Aßmann**, Jörg (2003), p. 118; cf. **Busse**, Daniel (2005), p. 95; cf. **Bergmann**, Gustav/**Daub**, Jürgen (2006), p. 2..
[64] Cf. **Aßmann**, Jörg (2003), p. 25.
[65] Cf. **Disselkamp**, Marcus (2005), p. 61.
[66] Cf. **Großklaus**, Rainer H. G. (2008), p. 32
[67] Cf. **Mast**, Claudia (2008), p. 94.
[68] Cf. **Disselkamp**, Marcus (2005), p. 62.

## 3.2 Conceptual levels of innovation systems in organisations

The goal setting process is only the initial, albeit decisive step in the implementation of innovation management within the company. In a second step it receives its fundamental planning imprint from the management level.

### 3.2.1 The creation of a "culture of innovation"

The targeted establishment of a corporate innovation culture is the most wide ranging concept within an innovation management system. Such a company culture can be described as collaboration that is open to innovation and promotes their development. Their effect unfolds largely on an informal, subliminal level; therefore it is often difficult for outsiders to grasp the innovation culture directly[69]. But even if it works as described, it can of course not exist without a formal structure within the company. It needs such a structure as its base[70], which ideally should assume the form of a comprehensive innovation promoting organisation structure[71].

So by implication, an innovation culture goes beyond the creation of appropriate formal structures. The creation of an innovation culture aims at animating those structures; a process to which the top management level contributes substantially by setting an example[72]. Although the term innovation culture thus inevitably leaves room for interpretation, a few attribute can be identified that generally characterize it. Thus, as part of an innovation culture, employees will receive freedom which allows them to "develop individual solution alternatives or the implementation of ideas beyond their actual area of competence"[73]. Other important characteristics are an open information and communication style within the company but also toward its environment, employee development as well as conflict awareness and readiness to assume a risk. For example, the readiness to assume a risk exhibited by a company exerts a substantial motivation effect on the employees[74], because risk aversion results in adherence to well-tried approaches. Novelties can hardly developed under such circumstances.

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[69] Cf. Wentz, Rolf-Christian (2008), p. 234.
[70] Cf. **Zedelius**, Werner (2007), p. 235.
[71] Cf. **Hessenkamp**, Vanessa/**Neumann**, Debra/**Holzmüller**, Hartmut H. (2009), p. 23.
[72] Cf. **Bausenwein**, Matthias/**Erett**, Anna (2009), p. 62.
[73] Cf. **Müller-Prothmann**, Tobias/**Dörr**, Nora (2009), p. 18.
[74] Cf. **Bausenwein**, Matthias/**Erett**, Anna (2009), p. 62.

An existing innovation culture expresses itself particularly as a general openness of the system of organisation[75]. It is ready to enter in an open information exchange with the environment and always signals openness to dialogue.

### 3.2.2 The specialisation of innovation

The creation of innovation culture naturally takes a great deal of time and therefore a lot of patience[76]. Nevertheless it poses a central conceptual key question for the innovation management of an organisation. Seen in the cold light of day, it is likely to appear in the form of a questioning of the existing innovation culture. Do we really have such a culture? How can the existing innovation culture be optimised and rendered more dynamic? Where are the differences between one's own innovation culture and that of competitors? Are there excellent role models by which we can orient our own innovation culture?

However, if so far no innovation culture exists in a company, then it is difficult to believe in such a change in direction from safety thinking to risk-taking, if there is continuity within the leadership staff. In such a constellation, this question of principle probably does not even arise. It is much more likely to appear in case of personnel changes, for example in the course of changes in ownership or succession planning.

Another question of principle aims at determining how much the internal innovation activity should be based on specialisation. Insofar as innovations are continually pursued, this is almost automatically associated with specialisation. After all, there is sufficient, continuous work within a specific area of responsibility to justify hiring innovation specialists and establishing departments for research and development[77]. This specialisation of innovation activity is not limited to the existence of these departments. Rather, it extends beyond the creation of a central point of contact, which is equipped with specific decision-making authority. For example, a board member could take over a corresponding auxiliary function or a special administrative department or staff position could be established, which is directly subordinate to the board[78].

"With an increasing degree of specialisation the possibility that employees really work on new things and thus produce radical innovations also increases"[79]. At the same time, however, good reasons argue against far-reaching specialisation. It is based implicitly on the presence of experts on innovation. Such experts, however, tend to make (sometimes crass)

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[75] Cf. **Müller-Prothmann**, Tobias/**Dörr**, Nora (2009), p. 18.
[76] Cf. **Wentz**, Rolf-Christian (2008), p. 234.
[77] Cf. **Hauschildt**, Jürgen (2005b), p. 168.
[78] Cf. **Daecke**, Julia (2009), p. 194.
[79] Cf. **Billing**, Fabian (2003), p. 121.

misjudgements regarding the degree of innovation of individual objects under consideration[80]. In addition there is a general latent risk that experts aspire to a form of professional perfection. In the context of innovation such a desire acts rather impedimental on other parts of an organisation[81]. Especially the failure to aspire to any form of perfection leads to a comprehensive willingness to innovate and thereby promotes the respective innovation culture[82].

Nevertheless, the question arises, whether a central point of contact, tantamount to a control centre for innovation in enterprises, might not be overextended with its intended task. The respective member of the board would need extensive and detailed expertise in many areas – such as technology, finance and marketing[83]. Whether this is given in the individual case, remains to be seen. It appears questionable, whether such a demanding challenge can be mastered at all - at least hypothetically.

Overall, there is a close link between the substantive point of specialisation of innovation activities in organisations and the local innovation culture. Looking at both individually in the context of innovation management ultimately proves to be rather futile. Long term creation of innovations almost automatically leads to a specialisation of innovation activity. If this is drastically and indiscriminately advanced, it begins to deprive the internal innovation culture of its foundation. With an increasing degree of specialisation the possibility of a ground-breaking creation also increases, but in the long run it also promotes a drying up of the internal innovation culture. Therefore, a company currently represented in the market with remarkable innovations, runs the risk of not being able to provide any more innovative answers to the market's future challenges[84].

### 3.2.3 The coordination of innovation activity

The formula for particularly long-lasting innovation success is thus a constant balancing act. The character of an innovation system should quite obviously in an ideal way unite an innovation culture with a specialisation of innovation activities. Undoubtedly, a company aiming at the creation of innovation can not do without specialisation of its innovation activities and certainly not without an innovation culture in the long run. Since both basic orientations are complexly interrelated, an innovation management can not focus

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[80] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 24.
[81] Cf. **Nebe**, Ralph (2007), p. 29.
[82] Cf. **Wentz**, Rolf-Christian (2008), p. 225.
[83] Cf. **Nebe**, Ralph (2007), p. 29.
[84] The fact that Sony had to cede its innovation leadership within the sector of entertainment electronics to Samsung is a good example in this context, cf. **Möslein**, Kathrin M./**Velamuri**, Vivek K. (2009), p. 489.

predominantly on one of the two poles without endangering the medium- or long-term innovation success.

According to the findings of the previous passages, the ideal interpretation of a company's innovation system should combine a far-reaching specialisation of innovation activity with as vital an innovation culture as possible. The trick to resolve the apparent contradiction seems to consist in granting the specialised organisational units openness – in the sense previously explained – and maintaining this openness. In this context, the management must exhibit technical management properties, which aim at a permanent coordination of both poles and focus on a proper tactic in dealing with the innovation specialists. Finally, it is important to make them aware of their importance for the success of the innovative process as well as that of the company and at the same time to avoid behaviours such as hubris or ignorance towards the environment.

Naturally the innovation system always requires coordination on the level of traditional management. In this respect, the management has to decide, for example, on the allocation of resources. Any allocation of resources must consider the planned layout of specialised organisation units and thus determine their staffing. Since their work usually focuses on more than one innovation project, they should be provided with adequate internal organisational structures. Project teams are often formed in practice. As with any competing company projects, there is a general rivalry, which primarily centres on the share of funds, access to test equipment or facilities or the provision of qualified personnel[85].

Generally, strong hierarchical organisational structures inhibit an innovation culture[86]. Nevertheless, the coordination efforts of the innovation system can hardly avoid creating or strengthening hierarchies. Last but not least, resolving conflicts between rivalling teams of different innovation projects and other departments of the company which have a negative attitude toward innovation activities requires hierarchical organisation elements[87]. Certainly a lively innovation culture aims at overcoming or avoiding any negative attitude toward innovation efforts. However, the specialised organisational units can prove to be a major disruptive factor, which is not opposed with regard to its content, but because it impedes the activities of other organisational units unnecessarily. After all, there are always certain connections between the individual areas of operation[88]. For example, the mass production of innovative products can only commence when the specialised organisational units have completed the development steps[89].

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[85] Cf. **Hauschildt**, Jürgen (2005b), p. 168.
[86] Cf. **Frohwein**, Torsten (2005), p. 32.
[87] Cf. **Hauschildt**, Jürgen (2005b), p. 168.
[88] Cf. **Billing**, Fabian (2003), p. 48
[89] Cf. **Verbeck**, Alexander (2001), p. 17.

Consequently, a core task of top management for coordination within the company consists in coordinating the work of the specialised organisation units, i.e. primarily the innovation teams, with the remaining organisation. For this purpose it is helpful to consider innovations on a process level. This innovation process should be clearly structured for the purpose of coordination[90]. Nevertheless a fine tuning is necessary even then. Therefore, one of the central tasks of innovation management is to deal with points of intersection that result within the innovation process as hassle-free as possible[91]. The development of such points of intersection can hardly be avoided, however, forasmuch as a company does not want to relinquish the benefits that result from extensive specialisation within the organisation[92]. Moreover, there is a process with its own internal dynamics that is inherent to radical innovation projects, which lead to the creation of new – unforeseeable – points of intersection within the respective innovation process[93].

Thus, the coordination of innovation activities has many facets, which contribute to the internal coordination of activities of specialised organisation units as well as to that of the entire innovation systems within the organisation. The coordination consequently comprises all measures which contribute or at least promise to contribute to the orientation of the internal transaction matrix toward superordinate goals[94].

### 3.2.4 Innovation system and Innovation capacity

At first glance, the innovation capacity of an organisation is determined from its quantitative equipment with relevant resources. "In particular, these are financial, technical, human and knowledge resources"[95]. Thus every major company would be automatically superior to all smaller competitors with regard to innovation capacity, which suggests the conclusion that it has a more efficient innovation system. Of course, a company with a budget of 200 m € and 100 employees within its specialised organisation units has factual advantages compared to a company with 20 m € and 10 employees. As a result of its limited resources, in the medium or long-term the latter always falls behind on a quantitative level. Accordingly, the innovation capacity of a company can also be defined simply as a set of innovations per unit of time[96].

In several regards, the external view on these kinds of key figures of an innovation system leads to vague ideas regarding the respective innovation capacity. It is possible that the

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[90] Cf. **Wentz**, Rolf-Christian (2008), p. 93.
[91] Cf. **Fischer**, Bettina (2006), p. 14.
[92] Cf. **Brockhoff**, Klaus (2007), p. 209.
[93] Cf. **Salomo**, Sören/**Gemünden**, Hans Georg/**Billing**, Fabian (2007), p. 220.
[94] Cf. **Billing**, Fabian (2003), p. 47.
[95] Cf. **Sammerl**, Nadine (2006), p. 77.
[96] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 168

company with the lower benchmark figures is merely a legally independent business unit of a large company, which as research laboratory, for example, possibly represents only a fraction of the actual innovation capacity of the entire group. Moreover, this view does not cover the essentials. It only includes the input of a company with respect to its innovation activities. However, output always proves to be decisive for survival in a competitive environment. If one understands this as measurable innovation success, components on a qualitative level inevitably become important for innovation capacity. These are factors such as learning ability, the ability to shape innovations according to customer expectations or the ability to market innovations[97].

The innovation capacity of an organisation therefore results from a combination of purely quantitative input parameters and the qualitative measurable parameter of promisingly and finally successfully implementing them. Thus, from an internal perspective, innovation capacity mainly becomes a latent issue: how much innovation can the respective organisation afford?[98] This question not only directly relates the two levels but it also displaces the rather static consideration of quantitative factors with a dynamic view of the output quality.

Finally, another key role of innovation management is to optimise the innovation capacity of an organisation especially on a strategic planning level. This means, an innovation management repeatedly restructures the innovation capacity in a planned manner, thereby adjusting it to the respective existing framework conditions of the overall organisation. Those conceptual restructuring processes may involve a steady expansion of the resource base, but of course they can also lead to a termination or outsourcing of specialised organisational units[99].

## 3.3 Main features of implementing an innovation system within a company

So far, we have engaged in isolated consideration of the individual elements that characterise an innovation system. Initially, these have been introduced from a conceptual perspective. However, the implementation of an innovation system already begins with the practically executed anchoring of the innovative idea within the superordinate business objectives. With the exception of newly founded businesses, the majority of the mentioned

[97] Cf. **Sammerl**, Nadine (2006), p. 77.
[98] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 169.
[99] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 172

components and functions of an innovation management should already traditionally be in place.

The quantum leap of innovation management consists less in new creation of such components and functions. The actual innovative element results from a novel view of the innovation activities in the company and its functionality. Mainly, its aim is to substitute a previously fragmentary approach by a systematic one. Its base is conceptual. Integration of the individual fragments of innovation management results in a standardized concept in the form of the innovation system[100].

The implementation, which is hardly talked about in the literature, results gradually from a systematic combination of the individual fragments. A tool, which itself can be regarded as a step in the implementation, proves to be important for a successful implementation. It is concerned with institutionalised rules like routines, which guarantee successful interaction of individual components or fragments[101]. An implementation also consists in considering existing facts from a fresh perspective and pursuing new ideas regarding these facts. Thus, the implementation of an innovation system expresses itself through the question of how much innovation a company can afford.

The main features of implementing an efficient innovation system do not appear spectacular overall; occasionally they are hardly noticeable for outsiders. They initially become recognizable rather sparsely, for example, in the form of a reorientation of the most important company objectives or through organisational restructuring. Occasionally, the latter can also include the hiring of an innovation manager. But the main features of the implementation process are often of a rather subtle nature. They result from content-related combination procedures, from a newly introduced coordination between and within the fragments as well as from the initiation of novel thought processes. In addition, the main features assume the characteristics of processes as they become continuous tasks. As a result they can lead to serious consequences for internal employees, including lay-offs. In the ideal case they are only spectacular for outsiders with regard to their innovative output.

## 3.4 Versions of a strategic orientation of an innovation system

Even the most successfully executed implementation of an innovation system in a company is not equivalent to the end of all conceptual contemplations in the context of innovation management. Instead, a transfer of the systematics of management activity to the area of

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[100] Cf. **Hauschildt**, Jürgen/Salomo, Sören (2007), p. 66

[101] Cf. **Gerstlberger**, Wolfgang/Kreuzkamp, Michael/**Kiesel**, Yvonne (2008), p. 384

innovation initiates the continuous progression of planning, implementation, control and monitoring activities. In this context, management means the consistent focus of an organisation on achieving set objectives. These are always stages and not end points. With respect to this it is important for the management to plan new approaches – at least periodically – which will make achievement of the next goal appear the most likely.
An important conceptual consideration in the context of innovation management concerns the version of strategic orientation of the innovation system to be selected. Even if a general decision was made in this regard, for example in the course of the implementation, the selected option can prove to be no longer suitable. Thus, the question has to be asked again and will possibly yield a different answer, because three versions of strategic orientation are available in principle.

### 3.4.1 In-house innovation management

The concept of innovation management tailored to an individual company appears as a particularly obvious variation among the three possibilities. Many companies in the German speaking region therefore direct their attention primarily to internally-oriented innovation strategies. Empirically recorded individual reports suggest such an assessment[102]. According to Hauschildt, from the perspective of the decision makers, in case of this version, the question arises, whether the implemented and planned innovation activities are an irregular progression of individual projects or a permanent task[103]. If they come to the conclusion that it is not a permanent task, the innovation management in the respective company takes the form of an individual project management. For this there are different potential organisation concepts. These options include, for example, the specialist department model and the staff model, the creation of pure project organisation and the matrix project organisation[104]. The latter envisions a temporary delegation of innovation specialists from different departments of the company, which changes with the requirement of the specific project.
However, the innovation activity of a company is perceived as a permanent task within the context of the present research. But even in this case the respective decision makers initially have to make a second decision on the path of strategic orientation of the innovation management. Insofar as one declares the own innovation activities a permanent task, it can take the form of multi-project management or of R&D-management[105]. "Multi-project

[102] Cf. **Granig**, Peter (2007), p. 185.
[103] Cf. **Hauschildt**, Jürgen (2005b), p. 160
[104] Cf. **Nebe**, Ralph (2007), p. 26
[105] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 66

management means the parallel or consecutive support of innovation projects by an authorized organisational unit".[106] Such an organisational unit can be equivalent to the organisational unit specialised on the practical promotion of innovations. That role can just as well be filled by a management committee on the level of business or corporate management[107].

Furthermore, according to Hauschildt, in case of permanent innovation activities, there is the possibility to organise the innovation management of a company as R&D management[108]. However, this view is not shared by all authors of the research literature. S. Hagenhoff points to a certain disparity, according to which the R&D-management simply consists of the intersection between technology and innovation management[109]. Thus, innovation management always comprises more than exclusive R&D management.

Notwithstanding, whether one wants to agree with this point of view or not, innovation management which is exceedingly geared toward the specialised organisational unit bears a number of risks, which have already been discussed above. Choosing this option appears precarious if only regarding of the balance between internal innovation culture and specialisation of the innovation activities. This by no means denies the existence of such an option with regard to the strategic orientation of innovation management. However, even Hauschildt emphasises that one should not "reduce [it] to project management within the framework of R&D departments"[110].

### 3.4.2 Intercompany innovation management

The innovation activities in many sectors are no longer limited to the narrow scope of an individual company. These limits are exceeded by engaging in active exchange with other companies, for example, also in the area of innovation. Thereby, existing specialisation advantages can be developed further. In addition, there is a multitude of research, which furthermore substantiates a strong positive influence of such collaboration on the technical and economical innovation success[111]. The now common interlocking of companies, with the aim to create and promote innovation, reveals why a pure consideration of input factors does sometimes not lead to clear results with regard to the respective innovation capacity. It does

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[106] Cf. **Gotthardt**, Cordula (2007), p. 120
[107] Cf. **Gotthardt**, Cordula (2007), p. 120
[108] Cf. **Hauschildt**, Jürgen (2005b), p. 160
[109] Cf. **Hagenhoff**, Svenja (2008), p. 23
[110] **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 67.
[111] Cf. **Gemünden**, Hans Georg/Walter, Achim (1999), p. 113

neither exhibit proof for exchange in the area of innovation nor the resulting increase of the potential for success.
Intercompany innovation management can refer to different respective orientations. Four of them are outlined in the following sections.

#### *3.4.2.1 Innovation management as procurement management*

Volkswagen AG has the goal to contribute to the optimisation of results in the areas of costs, quality and bundling of purchasing volumes by means of a comprehensive procurement management, which, in some cases, presupposes close collaboration with other companies[112]. If the intercompany procurement management sets innovation targets, this usually serves the pursuit of a differentiation from services of the competitors, which results in a greater advantage of the company's own service for the final customer[113]. An original creation of innovation is by no means automatically intended from the perspective of the customer in the context of such collaboration, since a comparable effect for the end customers also results if one searched for novel technologies along a supply chain and subsequently acquires them[114].
The acquisition of innovations in the supply chain can of course also take place through the purchase of licenses. This option suggests itself especially in case of process innovations.

#### *3.4.2.2 Innovation management as imitation management*

As different surveys prove, many successful companies pursue a combination strategy which combined the creation of innovations with utilisation of imitations[115]. In this context, innovations of other companies, for which either no or at least no sufficient industrial property rights exist, are imitated. Hence, this type of imitation would cause economical loss to the actual developers of the corresponding innovation, but this form of imitation would not be illegal. Nevertheless, there are cases of illegal imitation. There are numerous advantages for the imitator, such as a considerable decrease in costs. However, such activities also bear risks, because if the imitator decides to contribute his own innovations, his efforts will not result in any economic success.

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[112] Cf. **Koplin**, Julia (2006), p. 207.
[113] Cf. **Large**, Rudolf (2009), p. 57
[114] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 67.
[115] Cf. **Bea**, Franz Xaver/**Friedl**, Birgit/**Schweitzer**, Marcell (2006), p. 45.

#### *3.4.2.3 Innovation management as acquisition management*

There exists a comprehensive and for the trading organisation a frequently especially radical version among the multitude of possibilities for acquisition of innovations, which includes both procurement and imitation[116]. This version concerns the acquisition of entire companies, to which considerable innovative potential is attributed. In addition, the purchase of major shares in such companies also falls under this type of intercompany innovation management[117]. Acquisitions of innovative companies represent an important potential source for the acquisition of external competences which not least creates an opportunity for complementing one's own previous innovation activities. But in practice such an intention often proves to be illusory, since often inhomogeneous operating processes, contradicting company and innovation cultures as well as open resistance act as obstacles[118]. However, a technological objective so far, in practice, does not take a leading position among the motives for an acquisition. Instead, profit or market objectives prevail[119]. Although the intention to strengthen innovation capacity by means of an acquisition gains more and more relevance, the orientation of intercompany innovation management as acquisition management consequently is still of a rather theoretical nature.

#### *3.4.2.4 Innovation management as cooperation management*

In contrast, the option of an intercompany cooperation in the area of innovation is already a long-established version of strategic orientation of innovation management within a company. At least young technology companies are bound to revert to them, if they want to be successful in a competitive environment. After all, cooperation in connection with innovation for them is one of the critical factors of success[120]. However, one can generally assume such a correlation because the readiness for cooperation of a company automatically increases with the readiness to focus on its core competences[121]. Hence, all partner companies initially expect the cooperation to result in individual advantages. However, the cooperation always generates costs for the partners, whereas the

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[116] Cf. **Feldmann**, Christoph (2007), p. 352.
[117] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 74.
[118] Cf. **Hungenberg**, Harald (2004), p. 473.
[119] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 74.
[120] Cf. **Bolz**, Alexander E. (2008), p. 4.
[121] Cf. **Gelbmann**, Ulrike/Vorbach, Stefan (2007), p. 120.

materialisation of an advantage, especially in the area of innovation, must be considered as completely uncertain for a long time[122].

According to Hauschildt and Salomo, an actual cooperation regarding innovations only exists if a company creates an innovation in coproduction with at least one external partner[123]. However, other forms of collaboration of at least two legally independent companies exist. There is, for example, contract research. However, a customer relationship necessarily results from this, as the impetus comes from only one company which orders innovation activities from the other party on its account[124]. In addition, there is a constellation in which true joint research is carried out. This generally takes place in special institutions established for this purpose by the cooperated partners.

In some sectors, the cooperation activities hardly include bilateral mergers of two companies any more. Rather, full-fledged innovation networks form, in the context of which numerous participants network their innovation activities. The pharmaceutical division of chemical industry supplies a paradigm for such innovation cooperation. Many large-scale enterprises of this sector collaborate with biotechnology companies on that basis on a global scale, in order to develop cancer therapies, for example[125]. In this context, a central task of innovation management is to find suitable partners and to establish a formal framework for collaboration.

### 3.4.3 Innovation management involving a third party

There is, however, no reason to involve exclusively companies in such network structures. In view of the new creation of cancer therapies, involvement of patients, that is the end customers and their input will only be good for the success of an innovation in this field. Likewise, some university hospitals possess substantial innovation capacity. Additionally, they constitute an ideal area for in situ tests for cancer drugs and therapies, with the help of which the practicability of an innovation can be increased significantly, as is often the case for clinical tests[126]. Moreover, research organisations, like for instance state universities or science institutes, in many cases, are the addressees of contract research for individual enterprises. It is therefore consistent to incorporate them into existing networking structures. The results of the research produced are then at the disposal of all the partners and free capacities that can then be used for other activities of innovation. The essential conclusion

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[122] Cf. **Hagenhoff**, Svenja (2008), p. 151.
[123] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 81.
[124] Cf. **Gaubinger**, Kurt (2009), p. 358.
[125] Cf. **Fischer**, Bettina (2006), p. 43.
[126] Cf. **Lettl**, Christopher (2004), p. 248

regarding the willingness to cooperate also applies to innovation networks. The willingness to cooperate increases to the same extent that the tendency of focussing on the respective core competencies develops[127]. Participation in the network of innovation is thus principally possible for every party wanting to contribute in this regard.

Seen in the cold light of day, such networks of innovation can be regarded as a mere further development or an institutionalised specification of the network, in which most of the individual enterprises exist anyway with regard to innovations. Finally, the term innovation implies performance enhancement. The actual impetus for such an enhancement of performance frequently does not come from a manufacturing or service company. If one analyses, where the impulses for an innovation actually – at least partially- come from, one finds a considerable spectrum of initiators. K. Laursen and A. Salter, for example, list 16 different sources in this context[128]. Apart from clients and customers these include external counsellors, suppliers as well as competitors. In addition to persons and organisations, their list furthermore includes reasons for the exchange of information beyond the boundaries of the enterprise and for acquiring external information such as at trade fairs or industry events pertaining to a certain topic.

Only those persons and organisations which are not enterprises can be involved in the network of innovation as a third party. However, an extensive innovation management considers also other sources of an innovation impulse as important tools for procuring information and uses them systematically.

## 3.5 Factors of success and constraints of an innovation management exceeding the boundaries of the organisation

Activities of innovation that cross the boundaries of an organisation are thus not actually exceptions, but rather the rule. And, as mentioned, they form an important basis for the success of innovations, while providing new challenges for a company's innovation management. It is thus essential to develop a common system of objectives, wherein all the partners find their interests sufficiently considered[129]. Even in the closest of collaborations, the existence of individual interests of the respective partners must never be ignored. A party will revoke cooperation if its interests are no longer represented or even violated in the overall context. Others may have to be excluded from cooperation if they attempt to enforce

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[127] Cf. **Gelbmann**, Ulrike/**Vorbach**, Stefan (2007), p. 120.
[128] Cf. **Laursen**, Keld/**Salter**, Ammon (2006), p. 139.
[129] Cf. **Hagenhoff**, Svenja (2008), p. 137.

their individual interests at the cost of the partner. Elimination of such a kind can take place very quickly and occasionally even without prior notice.

An innovation management crossing the boundaries of an enterprise, crossing the borders of an organisation, thus basically operates on a very fragile basis. To strengthen it, even in this larger framework, the system requires institutionalised rules and routines, which ensure continuous collaboration of the partners. In contrast to the operational level, contractual regulations become increasingly important. The number of points of intersection in the innovation process necessarily increases with expansion of the innovation management. This is accompanies by an increasing need for coordination. Often, however, in case of organisational points of intersection, coordination cannot be achieved with simple instructions[130]. The majority of the new points of intersection are of an organisational nature. Therefore, a central task of innovation management is the analysis of such points of intersection in order to develop appropriate instruments for bridging them.
These particularly obvious ones shall conclude the descriptions of the most important challenges of an innovation management crossing the boundaries of an organisation. Whether they turn out to be actual constraints or not, significantly depends upon the capacity of the innovation management to cope with them. This, however, in many respects necessitates far-reaching support from the respective company managements involved. After all, it is in their capacity to make strategic decisions, which can sabotage any king of teamwork in the area of innovation. The corporate managements therefore have to forego any decisions that result in too strong a focus on individual interests for the duration of the collaboration or possibly take responsibility for its failure. Moreover, as mentioned, the respective top levels of management are accountable for the most important success factor per se: They shape the innovation culture of any enterprise, in the context of which such collaborations should be seen as investments in the future[131].

## 3.6 Methods of innovation management

The culture of innovation can be seen as a decisive factor of success on the comprehensive, strategic level. On the operative level, however, success is often based on solid methodological expertise and, in the context of innovation management organised in a collaborative manner, also on a well-thought-out coordination of the instruments and their

[130] Cf. **Brockhoff**, Klaus (2007), p. 208.
[131] Cf. **Spielkamp**, Alfred/**Volkmann**, Christine (2005), p. 289.

utilisation, because innovation management uses methods that are at the disposal of modern activity. Meanwhile, specific instruments have also developed[132], which constitute a broad range of tools[133]. They range from creativity techniques to marketing and controlling instruments to organisational techniques[134].

Detailed illustration of these tools would exceed the scope of the present research, wherefore only a few exemplary instruments will be listed. They can appear mundane, such as the company-wide ideas competition. However, apart from its direct effect, namely impulses for innovation, this competition also has an indirect effect. It is thus valued as impetus for internal as well as a signal for internal innovation culture[135]. However, in some German enterprises that use an internal suggestion scheme an institutionalised variant of this method has been in place for over 120 years[136]. An extended analysis of the strengths and weaknesses[137] and the optional organisation of a file of knowledge maps are also among the instruments[138].

This enumeration could be continued almost indefinitely. This, however, results in a problem, especially for small and medium sized enterprises. They have to make a choice useful to them, because their resources are usually not sufficient for integrating into their innovation management a multitude of different instruments.

## 3.7 Evaluation in innovation management

Similar to novel thinking in the context of innovation management the control of success has a central role. It has been touched upon indirectly in the form of the question regarding the amount of innovation, which a company is able to afford. In the course of innovation management the – previously by no means unknown – control of success takes the character of a continuous process. Any development of innovation activities is analysed regarding its achievement level and thus its probable success. In addition, systematic reaction of the survey results with the upstream steps in the innovation process and its relevant decision-makers. Naturally such a kind of control is also to be carried out systematically before each transfer of novel expertise[139]. Because of the systematic control which is always simultaneously assessed, the sporadic check becomes an evaluation. It

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[132] E.g. **Hübner**, Heinz (2002), p. 294.
[133] Cf. **Altmann**, Georg (2002), p. 51.
[134] Cf. **Disselkamp**, Marcus (2005), p. 94
[135] Cf. **Wördenweber**, Burkard/**Wickord**, Wiro (2004), p. 148.
[136] Cf. **Disselkamp**, Marcus (2005), p. 138.
[137] Cf. **Disselkamp**, Marcus (2005), p. 134.
[138] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 432.
[139] Cf. **Tintelnot**, Claus (1999), p. 7.

presents innovation management with one of its most difficult internal challenges, because the continuation or the end of the assessed innovation activities largely depends on this evaluation. Termination often bears the risk of enormous financial losses for the respective company. Sometimes this step can even ruin a business. On the other hand the continuation of a non-promising or less promising innovation activity also increases the financial risk.
Therefore, the evaluation proves to be an important step. It leads to quicker elimination of undesirable developments in the area of innovation and thus reduces the financial risk per se. On the other hand the evaluation requires exact methods in order to make a reliable prediction.
A systematically executed innovation management also evaluates itself of course. Interviews at regular intervals prove to be a suitable instrument for this. The presentation of the results as well as – if necessary – that of the planned optimisation steps are as important as the analysis in this context[140].

## 3.8 Specific scopes of actions and design constraints

"Innovation management takes place in space and time"[141]. It is thus exposed to a number of influencing factors which it has to face and to which it has to react, sometimes abruptly. Otherwise, a once installed innovation management proves to be non-functional. This shows the necessity of a self-evaluation. It signals not only the superficial applicability of the same rule for all parties involved in the innovation process and finally the seriousness of efforts to create a lively innovation culture. It also marks an important contribution for securing the ongoing success of this management system.

### 3.8.1 Conditions in an organisation

Such deliberations should of course form a basis for the concept of innovation management, before it is implemented. As already pointed to with regard to the methods, the individual conditions for each individual enterprise restrict the development opportunities within the innovation management. Establishing the functional position of an innovation manager, for example, is only possible for larger companies. In a new, innovative technology company such a task might be taken over by the entrepreneur as an additional task. Accordingly, the entrepreneur can only devote a fraction of his time to taking care of innovation management.

[140] Cf. **Stern**, Thomas/**Jaberg**, Helmut (2005), p. 274.
[141] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 49.

It is possible, however, that no great effort is required in view of the presumed, small size of the enterprise.
Hence, a specific innovation management process develops in each organisation. Standard solutions can be used, but they always must to be adjusted to valid local framework conditions. But generally, there is no valid formula for the success of innovation management[142].

### 3.8.2 Conditions of the respective market

This statement is explained by the very different market environments, within which the individual companies move. For example, in industries which regularly engage in innovation – for example the chemical industry in Central Europe – denying innovation activities the status of a permanent task is imaginable only in individual cases. The strategic decisions of the companies within the sector must be similar.

#### *3.8.2.1 Economic conditions of the market*

However, although innovations play a very important role in other markets, they are not decisive for securing the existence of the companies within these markets. Other factors certainly have an effect on companies within the building industry or logistics enterprises that act as subcontractors or suppliers. For them, the process of securing their existence is at least as dependent on the punctuality of goods and services as well as their overall quality. Undoubtedly, they also have a demand for innovation. This demand must not be expressed in the form of a permanent task, however. Instead, organisation in the form of individual projects would be conceivable.
Some branches even encounter innovation-averse groups of customers. Here, the question arises, whether systematic innovation management is really required. At any rate, it would only have to extend to subareas, because what product innovation do manufacturers of vinyl records require, for example. Here, the economical conditions reduce innovation management to a minimum or render it completely obsolete.

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[142] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 49.

*3.8.2.2 Non-economic conditions*

But not only the end customers and the economical framework conditions decisively codetermined by them gain influence on innovation management. The respective current conditions of the social, political and legal environments should not be underestimated[143]. Especially, since both levels are correlated. After all, a more negative social attitude toward certain innovations is not least reflected buying resistance.
Laws can declare entire areas of innovation activities to be illegal and effectively block them, declare them admissible again and reopen them. Legislature furthermore influences the concentration of innovations in a formative manner by means of its support policy. All those factors must be considered by functioning innovation management, in order to avoid wrong decisions.

# 4. The chemical industry in Central Europe

The market for chemical products can be described as globally organized. Even many small European companies in the industry do not produce solely for a national or regional market, but market their products on different continents. The global trade network of the chemical industry becomes particularly obvious in the case of large scale enterprises. "Whether from Rostock, Rio de Janeiro, Shanghai or Rome, every day BASF receives more than 4000 sales orders in Ludwigshafen alone"[144]. And what applies to the sales of this sector applies also to the procurement and the gaining of expertise as they are increasingly organised on a global scale.
Nevertheless, the same market conditions do not apply to all chemical industries worldwide. Naturally, this statement can be applied to virtually all industries. Such differences have developed historically. The chemical industry of Central Europe can be considered as an early global market leader with an absolutely dominant position. For example, C. A. Heaton states that in 1914 about 75% of the global capacity of the chemical industry was concentrated in Germany[145]. In Central Europe and especially along the river Rhine other producers were able to establish themselves back then. For example, in Switzerland, a chemical industry centring on Basel emerged, which specializes in niche products early on[146].

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[143] Cf. **Hauschildt**, Jürgen/**Salomo**, Sören (2007), p. 52.
[144] Cf. **Flickinger**, Bernd H. (1998), p. 83.
[145] Cf. **Heaton**, C. A. (1994), p. 1
[146] Cf. **Fráter**, Georg (01.06.2010), p. 34.

Several factors can be identified as the basis of this prominent position of the German chemical industry. They include the availability of important raw materials such as brown and black coal and the comprehensive salt deposits. But their mere existence is of only limited use in this context. The early efforts to provide a scientific analysis of the raw materials and the systematic research of applications are at least as important[147]. They introduced the development of technical processes and chemical technologies. In addition, they resulted in numerous ground-breaking innovations, which documented and maintained the exposed position of the industry over many decades. Among these are the development of synthetic rubber, fertilisers, detergents, transparent foils and synthetic fibres[148]. In the chemical industry in Switzerland these factors were accompanied by a lack of patent protection for a long time[149]. After its introduction, the global importance of the local chemical industry became evident in the form of enormous numbers of patents which traditionally are among the highest in the world in relation to the number of inhabitants[150].

Roughly speaking, the cradle of the modern chemical industry is located in Central Europe with Germany as well as Switzerland representing the core. The following passages thus focus on exactly this core. Over the decades, the local manufacturers in the chemical sector have had to face competitors from different parts of world. So far, they succeeded in doing so thanks to their specialisation and their innovation capacity. They still exist and some of them are among the top global companies in the industry. However, the challengers have contributed to a shift in market shares. In the year 2008, only 12.6 and 4.0% of the global export value are allotted to the chemical industry in Germany and Switzerland[151]. In the same year the Netherlands had a share of 5.2%, the United States of America a share of 10.9% and Asian countries such as the People's Republic of China and South Korea shares of 5.2% and 2.4% respectively[152].

At the same time, the German, and even more marked, the Swiss companies were able to initiate a process of catching up in 2005 that again increases the gap between them and most competitor nations. Only the People's Republic of China is an exception here[153]. However, the year 2009 marks a significant global decline in the chemical industry. Its total net production declined last year, although this decline was limited to the single digit percentage range[154]. The manufacturers in Germany recorded a loss of revenue of around

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[147] Cf. **Harald** (2001), p. 701.
[148] Cf. **Stahlschmidt**, Rainer (1977), p. 65.
[149] Cf. **Fráter**, Georg (01.06.2010), p. 33.
[150] Cf. **Legler**, Harald (1982), p. 124.
[151] Cf. **VCI** (2009), p. 106.
[152] Cf. **VCI** (2009), p. 106.
[153] Cf. **VCI** (2009), p. 112.
[154] Cf. IKB Deutsche Industriebank AG (2010), p. 2.

5% in 2008 and in 2009 they suffered another decline of almost 10%[155]. In view of these figures, it looks like the end or at worst even the reversal of the successful catching-up process is near if local manufacturers are unable to initiate another one on the global market with the help of their innovative potential.

## 4.1 The market players

Those manufacturers represent key players in the market for chemical products. Of course, just like in any other market, they are by no means the only ones. On the customer side there are predominantly companies from other industries, for example the automotive or construction industry. Nevertheless, 15% of the sales of the German chemical industry go directly to the end user[156]. Apart from these directly identifiable market players, national legislature also plays an important role for the market structure. It stipulated central framework conditions in many areas and becomes partially active through public institutions. This starts with granting of industrial property rights, includes the monitoring of concentration activities, and ends with the general prohibition of certain research projects in the area of biotechnology. It will be interesting to see, whether Venter's above-mentioned innovation may be taken up in Germany at all. Such institutions thus represent another indirectly identifiable group of players on the chemical industry market. However, the focus of the following sections is primarily on companies in the industry.

### 4.1.1 Large-scale enterprises

Unlike the products of automobile manufacturer, only a part of the products of chemical companies directly reaches the end consumer. Similarly, only a small amount of advertising addressed to the end consumer is required and the public is therefore not as aware of enterprises of this sector. Since usually the advertising budget is related to the respective revenue, this perception potentially extends to the large corporations of this sector. Most important for private households are drugs and cosmetics. Within the category of large-scale enterprises of the chemical sector, the perception of consumers concentrates primarily on those which offer both of these or at least one. Only this small group of large-scale enterprises is likely to have the opportunity to be perceived as innovative by private

[155] Cf. IKB Deutsche Industriebank AG (2010), p. 3.
[156] Cf. IKB Deutsche Industriebank AG (2010), p. 2.

consumers, while for most others other companies represent the relevant target group of the advertising efforts.

The German chemical industry association defines the company size according to the number of employees. Accordingly, small and medium sized companies with more than 500 employees are considered large-scale enterprises[157]. In 2006, this applied to around 140 of the 2000 German companies within this sector[158]. For Switzerland, more than 1,700 work centres are recorded in the areas of chemistry, pharmacy and synthetics by the Federal Office for Statistics[159]. Naturally, a company can have several operating sites and so the actual number of local chemical companies is lower. Approximately 830 are members of the national chemical industry association, 50 of which have more than 250 employees[160]. But only the approximately dozen that have more than 1000 employees are considered large-scale enterprises in Switzerland[161]. These are primarily concentrated in the region of North-West Switzerland and 4 large-scale enterprises of the Swiss chemical sectors that are of global importance have their headquarters in Basel[162]. If, however, the same standard is used as in Germany – namely 500 employees and more – the number of large-scale enterprises from the chemical sector in Switzerland would certainly be above 12 but most probably under 50.

The differentiation on the basis of these criteria does not yield a homogenous group of companies as the end result. Consequently, there are as many disparities within the category of large-scale German and Swiss enterprises as generally between large and small enterprises. For example: BASF SE alone has over 60,000 employees[163]. This corresponds to around 1/7 of the workforce of the chemical industry in Germany[164]. And this figure almost corresponds to the total number of employees within the sector in Switzerland[165]. Accordingly, the company has the potentially highest personnel-related innovation capacity. This is even higher if one considers the acquisition of Swiss Ciba AG with its approximately 13000 employees in the year 2008[166].

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[157] Cf. VCI (2007), p. 4.
[158] Cf. VCI (2007), p. 4.
[159] Cf. Bundesamt für Statistik (2009), p. 8.
[160] Cf. SGCI Chemie Pharma Schweiz (2010), p. 38.
[161] Cf. SGCI Chemie Pharma Schweiz (2010), p. 38.
[162] Cf. **Fráter**, Georg (01.06.2010), p. 32.
[163] Cf. VCI (25.05.2010), Fakten und Standpunkte.
[164] Cf. VCI (2007), p. 2.
[165] Cf. SGCI Chemie Pharma Schweiz (2010), p. 37.
[166] Cf. O. A. (15.09.2008), Chemie-Fusion.

### 4.1.2 Small and medium size enterprises = SME

The German chemical industry association defines the company size according to the number of employees. Accordingly, small and medium sized companies with more than 500 employees are considered large-scale enterprises[167]. In 2006, this applied to around 140 of the 2000 German companies within this sector[168]. According to another source, there are around 850 chemical companies of at least 50 and at most 499 employees[169]. This number corresponds to a share of approximately 43%. The other half of the approximately 2000 German chemical companies are small enterprises with a maximum of 49 employees[170]. SMEs thus represent more than 90% of all enterprises in this sector[171]. Unlike many other industries, those in the chemical sector are often not suppliers of large-scale companies, but customers[172]. The typical product areas of small and medium size enterprises are, for example, lubricants, diagnostic products and analytics as well as aroma and perfume substances[173].

In Switzerland, the SMEs are partially of greater relevance than in Germany. Nearly half of the 65,000 employees in the sector are not employed by large enterprises[174]. The comparative value for Germany is approximately 25%[175]. The almost doubled proportion in Switzerland is partly due to the rapid increase of biotechnology enterprises. Many of these approximately 210 companies with 11,000 employees are new start-ups[176]. Accordingly, most of these companies do not yet have many employees, but this does not necessarily correlate negatively with their innovative potential. Many of the start-ups were founded by researchers from the industry or from universities[177]. In most cases, innovation efforts gave the impetus for establishing them.

## 4.2 Framework conditions of competition

Both from the Swiss perspective and the German perspective, these start-ups must find their way in a rather dynamic competitive environment which dominates the entire industry in both

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[167] Cf. VCI (2007), p.4.
[168] Cf. VCI (2007), p.4.
[169] Cf. **Behr**, Arno/**Agar**, David W./**Jörissen**, Jakob (2010), p.5.
[170] Cf. VCI (2007), p.4.
[171] Cf. **Behr**, Arno/**Agar**, David W./**Jörissen**, Jakob (2010), p.5.
[172] Cf. VCI (2007), p.4.
[173] Cf. **Behr**, Arno/**Agar**, David W./**Jörissen**, Jakob (2010), p.6.
[174] Cf. SGCI Chemie Pharma Schweiz (2010), p. 15.
[175] Cf. VCI (2007), p. 4.
[176] Cf. SGCI Chemie Pharma Schweiz (2010), p.10.
[177] Cf. SGCI Chemie Pharma Schweiz (2010), p.10.

countries. Many different factors, partially in mutual interaction, add to the characteristics of the competitive environment.

### 4.2.1 Strong tendency toward international division of labour

Currently, more than 150 billion € from the overall revenue of the chemical industry in Germany are exports. The corresponding quota clearly exceeds the 50% mark[178]. With regard to the absolute volume of products sold overseas, it holds the top position globally and at the same time the chemical manufacturers from Switzerland have achieved the 9th rank and are now responsible for 4% of the world exports of chemical products[179]. Especially the market leaders among them achieve only a small fraction of their revenue in Switzerland itself. In 2009, the sales in the home market account for only 2% or 2.5 billion CHF of the gross revenue of the 10 big enterprises in the sector with a total revenue of nearly 150 billion CHF[180]. The rest came from foreign business.

In this respect, especially those 10, but in general also the entire chemical sectors in Switzerland and Germany, profit from the advanced international division of labour in their markets. They produce predominantly for the international market and in markedly lesser volume also for the national market. Simultaneously they are importers of chemical products which they then process further. Because of the "exceedingly broad product spectrum there is in the chemical industry" a general tendency toward international division of labour"[181]. Due to the different conditions governing location alone, there is lively cross-border trade with the required materials. Specialisations effected in the last decades also accelerate the exchange of pre-products and intermediate goods on an international level.

### 4.2.2 Relatively high labour costs

On average, employees of the chemical industry in Germany currently receive a gross annual salary of more than 47,000 €[182]. According to older data, their colleagues in Switzerland receive an average salary of 105,000 CHF annually[183]. Therefore, in both cases the sector is among the top group on a national level with regard to the paid salaries,

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[178] Cf. IKB Deutsche Industriebank AG (2010), p. 4.
[179] Cf. SGCI Chemie Pharma Schweiz (2010), p. 6.
[180] Cf. SGCI Chemie Pharma Schweiz (2010), p. 5.
[181] Cf. **Murjahn**, Ralf (2005), p. 26.
[182] Cf. **Behr**, Arno/Agar, David W./**Jörissen**, Jakob (2010), p. 5.
[183] Cf. O.A. (31.08.2006), Bröckelnde Löhne für Junge und Alte.

because in Switzerland the average gross salary in the year 2008 amounted to a little more than 5,800 CHF per month. The comparative value for Germany in the year 2010 is below 3,200 €[184]. From this, the annual salaries of not quite 70,000 CHF and a little more than 38,000 € can be calculated.

If, even from an internal perspective, the companies of the chemical sectors in Switzerland and Germany pay their employees above average salaries, this result becomes even more pronounced from a foreign perspective. At least compared to all the economies which are characterised by lower salary levels, these companies have a nominal comparative disadvantage regarding labour costs. However, in practice this only has an effect if comparable products of products from regions with different salary standards enter into direct competition.

### 4.2.3 Relatively stringent legal requirements

In 1986, the chemical company Sandoz in Basel caught fire. This resulted in a potential health threat for all people living downstream[185]. The water used for fighting the fire carried different and partly highly toxic substances into the river Rhine. A relatively limited fire within a well-managed chemical group became a threat to numerous people in three countries and an existential hazard for many animals and plants in the river[186]. The legislative bodies in Switzerland and Germany took this incident as an opportunity to continually expand the already existing regulations for environmental protection. In addition there are obligations in the area of consumer protection and even complete or extensive research or production bans in sub-domains. At present, in Germany the retrieval of embryonic stem cells is prohibited due to ethical reasons, but research with them is no longer as strictly controlled[187]. How Venter's innovation will be treated in Germany and in Switzerland, will probably be influenced by similar considerations. Generally, however, all requirements, limitations and regulation efforts by the national legislature represent an additional financial burden for the chemical manufacturers. The expenditures of German companies within the chemical-pharmaceutical industrial sector amount to 2.087 billion € in the year 2006[188].

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[184] Cf. Statistisches Bundesamt (20.07.2010), Bruttoverdienste.
[185] Cf. O.A. (01.11.2006), Der rote Rhein hat sich 20 Jahre nach der Sandoz-Katastrophe erholt
[186] Cf. O.A. (01.11.2006), Der rote Rhein hat sich 20 Jahre nach der Sandoz-Katastrophe erholt.
[187] Cf. O.A. (23.05.2008), Bundesratsbeschluß
[188] Cf. VCI (2009), p. 99.

### 4.2.4 Intensified competitive pressure

It becomes noticeable especially within the competition with competitors within national economics, to which such requirements do not apply or apply only in a moderate form. In any case, the competitive pressure within the overall market for chemical products has considerably increased in the last decade. Thus the states of the Asia-Pacific region contributed more than 50% to the global demand increase between 2002 and 2007. Their share with regard to the simultaneous development of production capacities is even higher and amounts to about 55%[189]. Consequently, companies develop in countries such as the People's Republic of China, India, Taiwan or the Republic of South Korea, which can meet an ever greater share of the local demand. At the same time they develop a growing potential to successfully position themselves in the global market.

A concurrent development takes place, for example, in countries like Russia, Brazil and Turkey. There the chemical manufacturers are not only catching up with regard to their quantitative production capacities, but many of them also establish themselves as producers of increasingly technology intensive products[190]. They represent ever stronger competition for the German, Swiss and other Central European chemical companies since they frequently have advantages with regard to wage levels and – as mentioned at the beginning – the state regulations imposed on them.

## 4.3 Securing the competitive position by means of innovation leadership

From the perspective of Central European and especially Swiss and German manufacturers, the competition on the overall chemical market can be characterised as a form of footrace. Long-term survival in this environment requires a specific strategy. If they want to maintain their current position in the existing conditions, this strategy often requires a consequent orientation toward the company goal of innovation. This also involves striving for a permanent leading position in the area of innovation in all relevant areas of entrepreneurial activities.

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[189] Cf. ZEW/NIW (2009), p. 48.
[190] Cf. ZEW/NIW (2009), p. 47.

### 4.3.1 Innovation leadership as consistent utilisation of innovations as competitive advantage

After all, it should be difficult for the majority of local chemical companies to predominantly compete by price. In view of the presented conditions regarding location in Switzerland and in Germany the chemical companies have disadvantages compared to their new competitors from the emerging markets. The capacity expansions taking place there furthermore potentially enable those competitors or even contenders to achieve economies of scale compared to local companies. After all, it is generally cheaper to manufacture 1,000 tons of sodium acetate in a production process than 100 tons. This, of course, applies to all manufacturing processes.

Such a price competition thus prevails especially in the segment of mass market for chemical goods. Especially large volumes are traded in the areas of raw materials and semi-finished products which constitute the basis for further product specialisations. The local producers of the chemical industry can thus try to avoid price competition by reducing their production of raw materials and semi-finished products to a minimum size and instead concentrate on further processing. However such a strategy no longer leads anywhere and an organisation of entrepreneurial activities mainly geared toward this aim must be considered outdated, because the contenders from the emerging markets no longer limit their portfolios to raw materials and semi-finished products. Instead, their chemical manufacturers dynamically advance their products in the course of a general technology boost within the respective national economy[191].

Hence a new strategic orientation of the Swiss and German, as well as all other Central European chemical companies demands a similarly dynamic development of their technological potential if they want to avoid price competition. The general path necessarily involves continuous innovation efforts. Due to the fact that the new contenders try to close the gap based on previously implemented activities for the creation of novelties in the chemical sector, the superordinate business objective of many local manufacturers should be innovation leadership. According to F. X. Bea, B. Friedl and M. Schweitzer this can be characterised as a consistent new equipment of the respective service catalogue with innovative offers[192]. This characterisation describes the previously outlined generation of innovations as business objective. However, this initially concerned the general and clearly recognisable anchoring of the readiness to innovate within the primary business objectives.

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[191] Cf. ZEW/NIW (2009), p. 47

[192] Cf. **Bea**, Franz Xaver/**Friedl**, Birgit/**Schweitzer**, Marcell (2006), p. 282.

The idea of achieving innovation leadership goes a lot further. The creation of novelties in the company in this context not only becomes an internal and external symbolical value but it is actively used to maintain the respective market position or to develop it further. The economic value of the novelty is assigned with its actual relevance on a strategic level. In connection with the achievable industrial property rights the innovations stand for temporary monopolies. These can be considered as resting places within the competitive footrace which due to their gainfulness constitute a starting point for further innovations. As long as the monopoly is in place, it invalidates the mechanisms of price competition or at least diminishes them.

In this respect, this "specific and permanent innovation activity" represents not only a practicable option for the permanent preservation of competitive capability[193]. In view of the framework conditions valid in chemical companies in Switzerland and Germany it increasingly becomes the mandatory course of action. Simultaneously, it has a more general effect on extensive parts of the national economies. Scientists, for example, state that the German chemical manufacturers have the potential to significantly influence other industries and sectors[194].

### 4.3.2 Innovation leadership through openness toward impulses: the principle of open innovation

The pursuit of continuous innovation leadership essentially calls for comprehensive planning[195]. All activities, which are geared toward generating novelties in the company, have to be recorded conceptually, coordinated and generally to be understood as management task. In short, this intention can only be efficiently and effectively implemented in the context of an existing innovation management. After all, the chemical manufacturers can hope to become an innovation leader in a sub-segment of the market or a market segment for a short time even by means of a rather unplanned development of a novelty. The hope for regular repetition of such a success as per the same incidental pattern of action and thereby for a continuous competitive advantage is most likely completely unrealistic, however.

As shown, the concept of innovation management limits the randomness in creating novelties, especially through a specific orientation of the innovation activities in the market. This orientation represents an important optimisation step because it significantly increases the chances of success of an innovation. Nevertheless it can still be optimised. The principle

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[193] Cf. **Bea**, Franz Xaver/**Friedl**, Birgit/**Schweitzer**, Marcell (2006), p. 283
[194] Cf. ZEW/NIW (2009), p. 21.
[195] Cf. **Bea**, Franz Xaver/**Friedl**, Birgit/**Schweitzer**, Marcell (2006), p. 283

of open innovation is a crucial approach in this context. It can be understood as an outward opening of the operational innovation process, which is only limited by considerations regarding efficiency, the assessment of realistic chances of success as well as the control capability. Consequently, one can classify the idea as a particularly consistent version of innovation management under involvement of a third party. From another perspective, the question arises, whether such a classification is suitable still, since the application of the individual methods subsumed under the term open innovation results in a paradigm shift[196].

Open innovation initially equals a potential expansion of innovation capacities of a company on the level of resources. The respective equipment with financial and technical resources remains unaffected to a large extent by the corresponding categories of different resources. However, the concept of open innovation has the potential to compensate for the given scarcity of the available knowledge resources – at least hypothetically[197]. This scarcity results from the capacity limits, which exist for a certain number of organisational members. After all, each of these employees of a company necessarily has inherent cognitive limitations. These limits certainly extend to personal as well as organisational factors. The latter can be approached by means of joint learning, for example. Nevertheless, the limits persist.

However, this fixed limitation by the capacity limits of an organisation disappears or at least transforms into a permeable limitation through integration of the knowledge of outsiders. This decreases the degree of knowledge scarcity on a quantitative level. At the same time, qualitative limits can be overcome with the help of this added knowledge. These limits consist of paradigms and perceptions of the members of an organisation[198]. Outsiders partly use different paradigms, hold different opinions and even indulge in different utopias. They occasionally take a completely different perspective. This frequently contributes to a fast solution of questions that before appeared insurmountable for the company[199].

Open innovation develops the knowledge of outsiders and furthermore partly involves them in concrete functions. Within the innovation processes of companies they are thus utilised not only as providers of ideas but also as concept developers or actively within the framework of the implementation of innovations[200]. Occasionally one can even describe the included outsiders as a complete one-person-project. For example, companies within the chemical sector, such as Henkel or BASF, utilise outsiders to develop complete solutions to innovation issues[201]. Consequently, the integration in the context of open innovation also contributes to a temporary decrease of the existing scarcity of available human resources. Examples for an

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[196] Cf. **Chesbrough**, Henry William (2006), p. 1.
[197] Cf. **Daecke**, Julia (2009), p. 19
[198] Cf. **Piller**, Frank/**Reichwald**, Ralf (2007), p. 116.
[199] Cf. **Piller**, Frank/**Reichwald**, Ralf (2007), p. 116.
[200] Cf. **Möslein**, Kathrin M./**Neyer**, Anne-Katrin (2009), p. 85.
[201] Cf. **Piller**, Frank/**Reichwald**, Ralf (2007), p. 115.

even more extensive overcoming of limits of human capacities by companies are found in other industries. The actual work force sometimes comprises less than 100 people but several hundreds of thousands of integrated nominal outsiders[202]. In such cases they are all potential customers who temporarily take the role of designer, product manager or salesman for the company. The pleasure of integration as well as the idea to create a product tailored to their own needs appears a greater means of motivation than direct monetary compensation[203].

Indirectly this also affects the financial and technical resources. At present, the specific transfer of tasks to outsiders in context of open innovation frequently turns out to be especially efficient and therefore relatively cost-effective when compared to internal processing. Furthermore, at least the companies of chemical industry necessarily revert to technical infrastructures, which are part of the outsiders' private property, for example laboratory equipment[204]. Thus the application of methods of open innovation directly or at least indirectly shifts existing limits in all categories of innovation capacity of a company. Moreover, the application also automatically and positively influences important components on a qualitative level, e.g., the learning capability, the capacity to design innovations according to customer demands or the ability to market innovations.

In view of these statements, the question of whether the principle of open innovation should be used as extensively as possible arises from the perspective of the company. This means that open innovation clearly shows a new way of combining purely quantitative input values with the qualitatively measurable possibility to promisingly and finally successfully implement them. If one enters this path, one could be tempted to limit the internal quantitative input values to a minimum. After all, the overall efficiency of the innovation process can be noticeably increased with the help of outsiders. Open innovation therefore offers the opportunity to continuously increase the competitive capacity of a company without simultaneously investing a great deal in the internal resources of innovation capacity[205].

At least with regard to the application of open innovation in the chemical industry, J. d. Wit, B. Dankbaar and G. Vissers emphasise that the promising potential of open innovation can be underlined by existing empirical research results, but that additional research is necessary to clearly identify the mechanisms responsible[206]. As long as one has to speak of presumptions rather than actual knowledge, the question remains utopian. F. Piller and R.

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[202] Cf. **Piller**, Frank/**Reichwald**, Ralf (2009), p. 106.
[203] Cf. **Piller**, Frank/**Reichwald**, Ralf (2009), p. 106.
[204] Cf. **Piller,** Frank/**Reichwald**, Ralf (2007), p. 115.
[205] Cf. **Wit**, Jan de/**Dankbaar**, Ben/**Vissers**, Geert (2007), p. 17.
[206] Cf. **Wit**, Jan de/**Dankbaar**, Ben/**Vissers**, Geert (2007), p. 17.

Reichwald explicitly emphasise that innovation should be considered as an important addition to the present innovation management and by no means as a substitute[207].

Therefore, a paradigm shift does take place because of the usage of the methods of open innovation, but only for those who used an innovation management system already prior to that. Open innovation is thus a second quantum leap within the innovation activities of a company, which results from the fundamental change in the approach to innovation triggered by innovation management. The facts about innovation management presented up until now are a necessary basis for understanding the functionality of open innovation. After all, it forms the archetype of an organisation generally open to innovation, which through open innovation is developed further into an organisation open to innovation impulses from all sides. Without knowledge of the archetype, its current modification, which is presumably only another step in the permanent process of change, cannot be duly appreciated.

## 4.4 The systematic integration of initiators from the business environment

Based on this perception, the principle is not primarily about a substitute for the existing internal innovation capacities but about their efficient expansion through integrating outsiders into the respective innovation process. From the perspective of innovation management this intention results in systematic integration of initiators from the business environment. The first step consists in systematically identifying them. In this process, the external initiators are primarily regarded as suppliers of ideas and as potential problem solvers and assistants in the process of implementing innovations.

### 4.4.1 The integration of impulses from universities and other academic organisations

In the chemical industry, a partly close collaboration between companies and universities as well as other academic organisations in the area innovations is by no means a groundbreaking new development. As outlined above, it has been common practice for a while, at least for Switzerland and Germany. However, this collaboration is usually based on a regulated scheme concerning a division of labour. The companies place orders and the

[207] Cf. **Piller**, Frank/**Reichwald**, Ralf (2007), p. 117.

universities, research institutes or academic organisations complete them. The paradigm shift accompanying open innovation entails being generally open to suggestions (for improvement) or alternative solutions coming from the outside. The rather one-sided communication direction due to the described constellation is given up in favour of a method of operation based on the reciprocity and participation.

In the context of open innovation, universities and other academic organisations establish themselves as more strongly perceived partners of innovation[208]. Furthermore, the impulses given by them must be consistently connected with the existing innovation management system. Special resources are required for the completion of this task, in order to systematically record the impulses and to evaluate them with regard to their possibilities of implementation.

### 4.4.2 The integration of impulses from specialised communication

For a few years now, several examples for such an allocation of resources have been in existence at least in the pharmaceutical segment of the Swiss chemical industry. There are several companies who have created the position of a central delegate and coordinator for external impulses. These positions are located on the second level of management and have direct access to the respective top management[209]. In those cases there exists a direct analogy to the suggested anchoring of the innovation management within the corporate structures.

Such centrally responsible persons should then also be responsible for a goal-oriented evaluation of innovation impulses, which come from different forms and channels of specialised communication. These include industry fairs and specialised conferences, symposiums, congresses, trade fairs, publications in specialised or technical magazines, exhibitions or special computer databases. According to an empirical study among British companies, these potential initiators already attracted attention in the year 2000[210]. This attention, however, turned out to be rather marginal and only the local chemical companies assumed pioneering position concerning this matter[211].

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[208] Cf. OECD (2008), p. 12.
[209] Cf. **Haid**, Philipp Emanuel (2006), p. 26.
[210] Cf. **Laursen**, Keld/**Salter**, Ammon (2006), p. 139.
[211] Cf. **Laursen**, Keld/**Salter**, Ammon (2006), p. 139.

### 4.4.3 The integration of impulses from external consultants

External consultants constitute another group that has attracted attention in the research literature as an external source of innovation impulses[212]. Particularly because of their changing work in different companies, they have the potential to overcome fixed opinions regarding issues of innovation characterised by a certain internal perspective. Furthermore, many of them therefore represent a form of individual knowledge network. Nevertheless, according to the empirical results from Britain, this source is not consistently utilised by companies[213]. Creative workshops, for example, would be a possible form of integrated development of that source, which additionally would allow involving other external experts. This instrument already belongs to the common repertoire of a few Swiss companies in the pharmaceutical sector[214].

### 4.4.4 The integration of impulses from suppliers

The ideas and initiatives regarding innovation activities originating from suppliers can be assigned to the category of impulses resulting from market forces[215]. In view of the German chemical industry one can speak of an almost customary integration of suppliers in the innovation process already today[216]. For the period between 2005 and 2007, a share of over 70% of companies located here states to have cooperated with suppliers regarding this matter[217]. Suppliers play a vital role mainly in the early phases of the innovation process. However, these figures only refer to the group among German chemical manufacturers that can be classified as actively innovative and a development reserve exists even there.

### 4.4.5 The integration of impulses from competitors

Generally speaking, innovation activities are subject to confidential treatment and information about them is guarded from competitors. But just as matter of course, attention is paid to corresponding efforts of competitors during the completion of innovation activities. After all, their innovation efforts decisively influence the success of a company's own activities. With

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[212] Cf. **Mensel**, Nils (2004), p. 85
[213] Cf. **Laursen**, Keld/**Salter**, Ammon (2006), p. 139.
[214] Cf. **Zeder**, Melanie (2009), p. 56.
[215] Cf. **Faber**, Markus J. (2008), p. 32.
[216] Cf. ZEW/NIW (2009), p. 1.
[217] Cf. ZEW/NIW (2009), p.1 4.

this in mind one can describe a closed or internal innovation process as follows: reveal as little as possible to the competitors and find out as much as possible about them.

However, an increasing transfer of employees to other companies leads to a similarly increasing transfer of knowledge[218]. In this way, a company automatically has access to a cross-company transfer of specific knowledge regarding innovation plans. Confidentiality is difficult under such circumstances.
However, the principle of open innovation disavows of extreme confidentially in any case. Instead, in the context of open innovation the mutual relationship of direct competitors is generally more open. Occasionally there are even limited partnerships in the area of innovation. Around 30% of the surveyed German chemical manufacturers state that they have entered such a partnership in recent years[219]. A current empirical study concerning selected Swiss chemical manufacturers from the pharmaceutical sector suggests a comparable result[220].

### 4.4.6 The integration of impulses from customers and potential customers

Successful companies traditionally involve customers in their innovation activities. After all, such a course of action promises a potential competitive advantage for the novelty created by them, which competitors can not claim without such integration. Consequently, the integration of impulses from customers and potential customers in the context of open innovation does not in itself represent an innovation. Rather, the accompanied paradigm shift includes a novel degree of this involvement. Customers are assigned an active role which can result in a process of co-creation with regard to the overall performance[221].
Due to the conditions in the chemical industry, the efforts for integration of customer impulses are strongly directed toward commercial customers[222]. A systematic development of the respective potential of private customers is possible, for example, through regular idea competitions. However, in the operational practice of Swiss pharmaceutical companies these are currently used less for the actual generation of ideas than as an instrument of customer retention[223].

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[218] Cf. **Daecke**, Julia (2009), p. 19.
[219] Cf. ZEW/NIW (2009), p. 14.
[220] Cf. **Zeder**, Melanie (2009), p. 56.
[221] Cf. **Piller**, Frank/**Möslein**, Kathrin/**Reichwald**, Ralf (2009), p. 4.
[222] Cf. ZEW/NIW (2009), p. 14.
[223] Cf. **Zeder**, Melanie (2009), p. 56.

### 4.4.7 The integration of other impulse sources

Apart from those mentioned so far, additional initiators can be found within the corporate environment during a consequent search. These include capital providers, technology parks or patent offices[224]. Likewise, important impulses originate from technical standards, safety, environmental and health regulations or generally from all regulations that apply to an industry[225]. As outlined before, this is particularly pronounced for the chemical industries of Switzerland and Germany.

## 4.5 New technologies for implementing the principle of Web 2.0

Many of the mentioned initiators belong to the information sources almost traditionally used by numerous companies. After all, the reverse would imply an organisation moving almost artistically within the market. The prospects of this company with regard to securing its continuous existence in the market would probably be extremely limited. In contrast, the approach to integrate them in a purposeful manner in the respective innovation process by way of the existing innovation management system and to thereby open up the innovation process is new. As mentioned, the allocation of resources is required to cope with this new challenge.

These include the already mentioned human resources. These have to be provided with technical equipment which facilitates their work. A currently developing new technology offers enormous potential concerning this matter. Web 2.0 promises considerable progress with regard to the integration of customers. This progress concerns the intensity of interaction as well as the implementation of integrative efforts on part of the companies. By now, the name Web 2.0 stands for a number of different developments and applications of a novel information technology. Novel possibilities of networking and the accompanying voluntariness of collaboration of computer users constitute the connective elements[226]. Web 2.0-applications almost symbolically stand for a technology, which emphasise the above mentioned principles of reciprocity and participation in the context of open innovation.

At present the creation of new products, which are as easy to manufacture and modify as i.e a T-shirts on www.spreadshirt.de, is successful with the help of such applications and direct involvement of private customers. They furthermore already involve customers as co-

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[224] Cf. **Faber**, Markus J. (2008), p. 32.
[225] Cf. **Laursen**, Keld/**Salter**, Ammon (2006), p. 139.
[226] Cf. **Büttgen**, Marion (2009), p. 57.

developer and co-producers in the context of much more complex innovation projects. Royal Philips Electronics, for example, has been using this option already since 2007[227]. For quite a while already, Web 2.0-applications have also been finding application in the local chemical industry. There they are used especially in the pharmaceutical and cosmetics sectors, however, mainly within the context of customer retention and public relations[228]. This, however, does not prove a general lack of suitability for the application within innovation processes of the chemical industry. Rather, the previous reluctance can be explained with a "sluggishness" of the companies. This in turn does not least result from the fear of breaching regulatory requirements by means of a forced integration of private customers into the innovation process[229].

## 4.6 A company open for receiving all of those impulses

This fear might be justified in case of a number innovation processes. However, there probably are many others at the same time, in which impulses from private customers can be integrated without too much of a problem. Development potential with regard to an implementation of the principle of open innovation definitely exists in case of local chemical manufacturers. On the other hand, current research of the innovation situation in German companies within the chemical sector comes to the conclusion that "open innovation is the standard in today's chemical industry"[230].

The evaluation of the situation thus quite obviously results in a striking contradiction. This conclusion should in no way astonish a neutral observer. After all, there is no generally binding definition of open innovation. Therefore, different components can be subsumed under the term, which in turn enables completely different results for the existence of the principle in practice. Three different courses of action are described by the term open innovation, which at the same time represent different perspectives.

One core process, for example, assumes a view point that leads from outside to inside[231]. This archetype of open innovation refers to the collection, accumulation and integration of external knowledge into the innovation process of a company[232]. A second one takes place from the exact opposite perspective. It pertains to marketing of internal knowledge regarding

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[227] Cf. **Grabenströer**, Nadja (2009), p. 30 et seq.
[228] Cf. **Hahn**, André (2008), p. 51.
[229] Cf. **Zeder**, Melanie (2009), p. 42.
[230] Cf. ZEW/NIW (2009), p.13.
[231] Cf. OECD (2008), p. 21.
[232] Cf. **Faber**, Markus J. (2008), p. 36.

innovations, which does not belong to the actual core business of a company[233]. A third one links both perspectives in the form of the so-called "coupled process"[234]. When considered in isolation, all three core processes stand for one ideal step of opening up in the process of innovation. Each of these steps can assume different facets and specifications in operational practice. Even concentrating on the first step and its excessive implementation promises economic success, as can be seen from the example of the T-shirt manufacturer. It evidently avails itself of the opening of the innovative process in the form of crowd sourcing which leads from the outside to the outside. Crowd sourcing can be understood as the fortification of internal knowledge by integrating numerous external and expert individuals. This is primarily carried out in the course of a tender for specific company functions within a comprehensive network[235].

A current study states that so far the Swiss pharmaceutical industry has not used this extreme form of the first step to an opening of the company[236]. From this result one could derive that there is no use for the principle of open innovation in local chemical companies. But how valid would such a conclusion be?

Within the framework of the present research, open innovation is regarded as a tendency to further development within the innovation management. Moreover, many of the contents mentioned earlier are regarded as outlines for ideal situations. The core statement of this often still hypothetical impulse for further development of individual innovation capacity remains untouched by this. It comprises the consequent advancement of the term of openness in the context of innovation culture, because - as already stressed earlier – its existence is primarily expressed through a general openness of the company system[237]. In the context of open innovation this signals a general willingness to engage in a dialogue with potential initiators who were not considered before. Moreover, a company open to receiving all these stimuli at least deals with the option for both of the continuing steps within open innovation.

## 4.7 Resistance and the hazards to the principle of open innovation

Whether these can actually be implemented depends on the individual circumstances of every single company, because overall the planned implementation of the principle of open

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[233] Cf. OECD (2008), p. 21.
[234] Cf **Faber**, Markus J. (2008), p. 37.
[235] Cf. **Zeder**, Melanie (2009), p. 4.
[236] Cf. **Zeder**, Melanie (2009), p. 56.
[237] Cf. **Müller-Prothmann**, Tobias/**Dörr**, Nora (2009), p. 18.

innovation implies substantial courage, as it means a radical change compared to previous practice. All radical changes hold the potential of expanding the scope of a company's activity through reorganisation. They also hold within them the danger of hitting obstacles. And surely, the respective company itself represents the biggest of obstacle to begin with. First it has to be ready to specifically focus on such a change. Those favouring innovation should not perceive it as an obstacle if they do not yet use the instruments and methods of open innovation outlined here. Companies with a less lively or little pronounced culture of innovation are much more likely to stand in their own way. Their motivation for opening the innovation process considerably depends on what opportunities it offers and whether one can handle or limit its dangers; because of course it bears risks. Companies can quickly become overwhelmed by an excess of innovation impulses, which then possibly do not lead to a positive effect but only to additional costs. Hence, it is necessary to answer a number of practical questions beforehand. Who in the company receives the stimuli? Who archives and administers them? Who evaluates them? Who is actually responsible for their advancement within the innovation process? Where do all the resources needed for this purpose come from? The search for systematic innovation successes on the basis of the principle of open innovation therefore requires systematic preparation by the respective company.

Moreover, the balancing act described above between the innovation structure and the specialisation of the innovative activity turns out to be even more difficult now. Open innovation can be understood as valorisation of the innovation culture, but the element in interplay with it must not be overlooked because of this. As the occurrence of crowd sourcing shows, open innovation can be perceived as a threat by the innovation specialists in the company, because it implies outsourcing. Even true promoters of innovation may frequently not be taken by such a change, if they feel that their professional existence is threatened by it. Without their commitment, however, the prospects of a success of open innovation are very dull at best. If a company wishes to minimise internal resistance to open innovation it should take action beforehand to counteract the fears of its employees.

The corporate risks of open innovation include unintentional disclosure of secret knowledge. It is up to the companies, however, to develop mechanisms that can avoid precisely this. Certain precautions should therefore be taken when dealing with external initiators which can be gradually reduced once mutual trust develops. It is thus up to every individual company to overcome resistance on the path of open innovation. The only factors that they have no direct influence on are the regulatory efforts of lawmakers. They are free to indirectly influence these, however.

# 5. Empirical findings regarding industry specific innovation management

Diverse empirical data and derived statements have been included in the contents of the present study so far. The second to last chapter completes it with original findings. These merely constitute a random sample, however. Nevertheless, they can serve to examine the information provided before on the topic of innovation management as well as the principle of open innovation within local chemical companies, because although the statements made previously are based on the research literature, the question remains whether and in how far such impulses are (already) relevant in practice.

## 5.1 Methodology

The present empirical findings were collected in several individual, double and group interviews conducted June 21 and July 25, 2010. All respondents directly or at least indirectly belong to the Swiss chemical industry sector. All interviews were conducted on the basis of a standardised interview guide. This interview guide is similar to a questionnaire and was sent to the participants in advance to give them the opportunity to prepare the contents. All survey results were recorded in writing immediately and subsequently bundled into thematic units which form the contents of subsection 5.3.

## 5.2 Design of the interview guide

The guide designed for the interviews is divided into two sections or blocks. Block A comprises 6 and Block B comprises 5 questions. The first 6 questions primarily aim at finding out in how far the statements from the research literature actually correspond to current practice. The questions of Block B, however, serve the purpose of illuminating in more detail individual practical aspects. Not all participants answered all questions in details. Nevertheless, the respective contents provide a rather complete picture which differs depending on the specific situations and perceptions of the interviewed persons. The questions were as follows.

Block A:

- Do you consider the systematic handling of innovations, i.e. their planning, control and evaluation, as a common standard in the industry?
- How long have you been dealing with innovations in this manner in your own company?
- Would you say that the company as a whole is geared toward innovation?
- Can you name and outline two to three innovations that have recently been implemented within the company and generally made available to the public?
- Would you say that the handling of innovation in the company is exclusively a matter for the "boss"?
- A number of companies from different industries have been utilising all possible initiators of innovations – namely also customers, suppliers or potential customers - in their innovation management for quite a while. What is a normal business activity for many companies has become a focus of research. Science uses the term of open company in this context. Would you use this term to describe your company?

Block B:

- If not, how does it differ from an "open company"?
- The topic of innovations - and even that of innovation management – is by no means new to companies. But two decades ago the focus was on impulses provided by the company's own employees (internal suggestion and improvement system). If now many additional potential channels are tapped, this also leads to an increase in work. After all, all those impulses must be evaluated and quick feedback must be ensured. How does the company deal with the aimed for increase in impulses (for example with the help of additional resources; by strict pre-selection)?
- Especially impulses clients require very sensitive handling, because if these impulses prove to be impossible to implement, this information could case the customer to switch providers. Does the company take any special precautionary measures concerning this matter; for example by means of trainings or in the form of general reward systems?
- Where do you perceive pitfalls in dealing with customers as initiators of innovations or do customer relations not pose any special challenge?
- In general, how do you judge the model described above of the company open to innovations from all sides?

## 5.3 Interview results

Statements have already been made in the text passages above regarding the results of the survey. On request of some interview partners, the further explanations are provided without giving any names. Names have been substituted by the professional title of each person.

### 5.3.1 Interview 1: association spokesperson

Due to the lack of relevant comprehensive studies, this interview partner based his statements solely on personal impressions. According to these there is no process of innovation according to the principle of "open innovation" in the Swiss chemical industry. As main obstacle he cites the current legal regulations. In view of the increasing regulation efforts that the sector is faced with (key words: FDI and Reach) their impeding effect will become even less surmountable.

He also points out that open innovation could be taking place without being perceived as such or without becoming known, because there is a certain amount of integration of external initiators. It is noticeable that manufacturers move closer together in the context of specialised seminars or conferences. Even collaboration with universities is pushed. This, however, often pertains to a more general exchange of information. In any case, sharing of knowledge in the industry is always accompanied by legally binding confidentiality agreements.

### 5.3.2 Interview 2: spokesperson of a supplier of the industry

Innovation management was introduced in the company more than two decades ago. A corresponding system has been implemented within the entire company. It makes each employee who is in contact with external partners a competent contact person regarding innovation. After all, the chemical company perceives itself as geared toward innovation. However, the company actually only has little liberty with regard to innovative activities as it usually merely implements customer specifications. Accordingly, the impulses for innovation predominantly originate from the company's commercial clients. Moreover, supply is mostly exclusive and the manufacturing of most of the products is carried out in the context of bilateral confidentiality agreements. They regulate the business relations between the company and its respective individual clients.

Nevertheless, the company engages in activities that are geared toward open innovation. It collaborates with universities, for example, to generate external knowledge. Likewise, the company participates in conferences and specialised seminars. It even engages in technology exchange with competitors. This is primarily to be perceived as a form of benchmarking and consequently permits orientation toward the system leaders. A way of integrating external knowledge within the industry not mentioned so far is through shares and holdings or joint ventures with start-up companies. This option for opening the process of innovation through acquisition promises to speed up the entire process considerably. Due to its financial requirements and risks it is only an option for large-scale manufacturers.

### 5.3.3 Interview 3: employee of a sub-organisation of the business development office of the canton of Basel-Stadt

The –still relatively young– sub-organisation has established an innovation circle in which the local university and small as well as large local chemical companies participate. In regular intervals the circle engages in the exchange regarding innovative applications of nanotechnology, with 2/3 of the thematic input originating from the companies and 1/3 from the university. The entire circle is subdivided into respective subgroups, the formation of which took almost a year. The exchange of knowledge within these subgroups is rather careful and cautious. Contact is gradually becoming more open, however. The basis of this slow gradual change is mutual trust growing at the same speed.

The absence of bureaucratic regulations and primarily the adherence to an unwritten law of coexistence have proven to be beneficial for building trust. This eliminates the involvement of representatives not willing to engage in an actual exchange of knowledge in the subgroups. Overall, the companies give an impression of dedication, which takes the form of generally well-organised and purposeful preparation, for example. On the one hand, they use the innovation circle as a platform for their own opinion forming process; on the other hand they consistently search for complimentary knowledge, to expand their own knowledge store. Externally, the activities of the participants become evident in the form of several studies ordered on the national level.

Indirectly, the open network in the innovation circle is characterised as extraordinary, because the chemical industry and the associated pharmaceutical sector exhibit a relatively high degree of closeness. An opening of the process of innovation only takes place bilaterally and contractually stipulated confidentially always plays a major role. The regulation efforts of the lawmakers impede a fundamental change. In view of these framework conditions, the principle of open innovation with regard to the industry is considered a farce. However, some

opposing tendencies are evident. The massive competitive pressure that some chemical companies are exposed to, for example, fosters the opening efforts of these companies. The pharmaceutical division, on the other hand, for which the pressure of competition is not as pronounced yet according to the assessment of the interviewee – is clearly more reserved.
In general, increasing openness toward local universities can be observed. In the area of innovation activities this predominantly takes the form of research contracts. Joint ventures are the exception. National lawmakers wish to intensify the existing networks, which is why the Federal Council is presently developing measures pertaining to optimised knowledge and technology transfer between universities and companies. In contrast, the interview partner rejects more extensive commitment as exists in some European countries in the form of detailed master plans. This is because he feels that an innovative environment can only be organised bottom up and can not be stipulated from the top. From the composition of the innovation circle he further deduces that open innovation, if it exists at all, is a responsibility of the top management.

### 5.3.4 Interview 4: head of the business area exploration department of an industry giant

Innovation management has a long-standing tradition in the company, which uses the Gate-Stage-Model. The present reorganisation of the internal R&D department envisages the foundation of a central unit, which should take up joint topics from the 9 business areas. Specific topics and questions are still the responsibility of the R&D units of the respective business areas. Similar to this subdivision, internally generated ideas are compiled within the business areas or even their respective departments. No general and systematic compilation and archiving take place and neither are the ideas checked regarding feasibility. The necessity of more pronounced internal networking has been recognized, but so far it is hampered by technical questions regarding the management of the ideas as well as an incomplete comprehensive innovation culture.
In any case, the company as a whole does not classify itself as very open. Reasons for this are the historical context of the entire industry for one, and the specific market environment. Private end customers are not directly relevant for this company. Its clientele are exclusively industrial customers. The B-to-B market environment is primarily concerned with the search for competitive advantages, which often turns into a sole matter of price. Nevertheless, innovation impulses also come from industrial clients and, of course, the company takes these up. The majority of these are merely proposals for product adjustments and relatively small modifications, for instance, changes in packaging. This form of openness toward

specific customer wishes is common practice and has become almost a kind of industry standard. It is, however, not exactly seen in the context of open innovation, but rather classified as normal service feature for key customers.

Moreover, the company has gradually emphasised teamwork with universities and other scientific organisations in recent years. It serves the purpose of obtaining external knowledge, mostly consisting of components that are not close to the market. Regarding such knowledge there is even collaboration with direct competitors. Contents that concern the area of innovation play almost no role here, however.

According to the interviewee, the concept of innovation is at best considered to have marginal chances of implementation within the industry, because it is confronted with too many obstacles. The activities of innovation in the sector are usually associated with substantial investments in research. Knowledge generated in the process of innovation thus becomes a valuable resource, which needs to be protected by patents and not shared with others. He furthermore characterises the chances of successfully creating innovations via a process of crowd sourcing (accumulating internal knowledge by involving numerous external and expert individuals) as extremely low.

These findings are of a purely hypothetical character, however. This form of openness and integration appears to be less promising in general, because one considers the problems to be dealt with as very specific. Successful solutions require a substantial amount of specific expert knowledge that one hardly thinks external private individuals to be capable of. Instead one fears to receive a great number of suggestions regarding the innovation process but little overall quality. Such a constellation then raises the question regarding the relationship between expenditures and yield. The concern of open innovation merely causing substantial processing effort and to do oneself a disservice increases even more with view on competitors and some customers. After all, by engaging in open innovation one could play into the hands of the competition by granting them unwanted insights into one's own innovation efforts. Even customers can not always be assumed to be telling the truth. Opportunistic behaviour or plain ignorance regarding their personal needs can be the cause here.

The interviewee states that no further opening of the innovation process and especially no handing out of free knowledge is to be expected on the part of the companies in the industry. Even greater seclusion appears likely.

### 5.3.5 Interview 5: 2 representatives of a public company with a focus on life sciences

Interviewee 1:

Even though the industry environment is perceived to be rather conservative, clear efforts of implementing the principle of open innovation are evident within the company. There are collaborations with universities, customers and external consultants. Nominally, the company also envisages the involvement of suppliers, other external experts, investors, innovative start-ups, other scientific organisations as well as cross-industry stakeholders. However, such extensive openness is confronted by the reality. Although he sees himself as a promoter of the principle of open innovation, the interviewee cannot avoid reporting negative experiences during the implementation of it. Several transfers of patents never resulted in commercial gain, for example.

The further opening of the company is mainly opposed by the fear of divulging trade secrets in the process. Moreover, the concern of receiving large numbers of innovation impulses via crowd sourcing while hardly being able to systematically collect and evaluate them is becoming more prominent. Substantial input of resources might then not be balanced by adequate commercial gain. Already, internal knowledge hardly or insufficiently circulates, because its integration is confronted with practical barriers. An effective incentive system has been missing, though generally the topic of innovation is not a management matter but a responsibility of every individual employee.

Overall, the interviewee assesses open innovation as a principle which one inevitably must use in the future, in order to cope with increasingly complex challenges. Some of the complex problems already threaten to overwhelm individual companies. They need partners with whom they can network and exchange knowledge. Increasing implementation of this principle should, however, be accompanied by different measures. It needs appropriate roots in the corporate guidelines regarding the process of innovation. Contracts for collaboration should increasingly focus on regulations concerning joint knowledge acquisition and thereby provide more security for all participating partners. This would increase the trust throughout the entire process of development, which at the same time constitutes its indispensable basis.

Interviewee 2:

The topic of innovations is, by no means, a matter of management in the company, but rather a task to be carried out by all employees. The corresponding culture must, however, be lived by the management and provided with adequate framework conditions. In contrast, the external opening of the process of innovation is still rudimentary. Patent problems as well as

the rather conservative approach of the industry are obstacles. Additionally, the necessary special knowledge turns out to be an effective barrier. It hinders the joint development of new products in joint ventures with external partners which is evident even internally. The members of the top management in the company are themselves only experts in their respective fields. The activities of the company, however, comprise a great range of disciplines. A comprehensive assessment of the potential value of innovative approaches by a person in the company therefore seems to be impossible. Creating a platform for focusing internal expert knowledge has been envisaged as a solution.

For the future, the interviewee considers necessary increased cooperation with other chemical manufacturers and generally with other companies in the area of innovation activities, as well as increased openness. This process, however, has to consider and preserve the existing rights of the partners. An already practiced version of generating external knowledge through acquisition represents a great challenge and a massive risk at the same time, because correctly assessing the innovative capacity of such a purchase is difficult.

### 5.3.6 Interview 6: group discussion with decision makers of smaller supplying companies from the pharmaceutical sector

The general trend of the discussion was that open innovation is not a new but a traditional principle within the traditional pharmaceutical sector. Due to its development and production of complex products, close collaboration of different partners is indispensable. In contrast, the principle is less common among traditional chemical companies. Market forces are an obstacle to its dissemination. The chemical industry exhibits another and extremer degree of specialisation that renders integration of external persons and any form of crowd sourcing very difficult. On the other hand, the production according to the exact standard of industrial customers more often results in an oligopoly. Close cooperation between two or more chemical manufacturers in such a position would be perceived as a threat by the industrial customers. This would either lead to a direct competitive situation or a very dominant position of the cooperating chemical companies, namely a monopoly. This can also result from close collaboration of the chemical manufacturer with one of its industrial clients.

In any case, companies generally seek to dominate the respective market. Protecting one's own patents therefore becomes increasingly important. After all, they are an important instrument for potential market control. This opposes the principle of open innovation. Additionally, increasing regulation or at least the fear of such overshadows all. This leaves

the companies with very little room for freely developing and this affects even the process of open innovation.

# 6. Conclusion

If one takes a look at the survey results, one impression is particularly prominent. The regulatory procedures and intentions of the lawmakers, including patent legislation, are consistently perceived as efficient barriers, opposing the implementation of the principle of open innovation. In contrast, the presence of innovation management appears to be a traditional standard in the companies of the Swiss chemical industry. In so far, the question regarding the general organisation of the planning, control as well as evaluation of innovations asked at the beginning is no longer relevant to them. All three subareas have long been implemented in the context of a management system.

However, even with regard to the openness of the innovation process toward third parties or its advancement in the form of open innovation, on second glance the conclusion is by no means as sobering as the first impression might have one assume. Repeatedly, scepticism is voiced with regard to the principle and its implementation. At the same time, however, collaboration with third parties and even increasing intensity of such collaboration is confirmed. It is possible that the scientific impetus regarding open innovation as well as the corresponding echo from operational practice diverge because of a misunderstanding. Even on the level of business research, the term of open innovation is still relatively new. It can be understood as a direct continuation of existing innovation management trends of individual companies. It can, however, also represent a still hypothetical construct, an ideal, which at the moment summarises rather isolated practical examples into a complete concept.

If the companies take this ideal as a benchmark, they cannot avoid challenging the implementation possibilities of such a comprehensive concept. This concept, should rather be understood in the sense of describing and simultaneously specifying the direction of future development of innovative activities. As can be gathered from the statements of their representatives, the companies surveyed have undoubtedly already taken steps in this direction. Whether or not they will consistently continue on this path cannot yet be judged correctly today. The industry will not be able to elude or oppose this development in the long run. At the same time, this development within the industry will assume a specific character, which will most likely be influenced by the framework conditions of the market and particularly any regulatory activities. Additionally, any company must adapt the helping hand offered by open innovation to its individual needs.

It is possible that a follow-up survey in 10 to 20 years would show open innovation as traditional standard in the companies of the Swiss chemical industry.

# Bibliography

**Abramson**, Mark A./**Littman**, Ian D. (2002): What do we know about Innovation? In: Abramson, Mark A./Littman, Ian D. (Hrsg.): Innovation. Lanham, Oxford, p. 1-13.

**Altmann**, Georg (2003): Unternehmensführung und Innovationserfolg. Eine empirische Untersuchung im Maschinenbau. Wiesbaden.

**Aßmann**, Jörg (2003): Innovationslogik und regionales Wirtschaftswachstum. Theorie und Empirie autopoietischer Innovationsdynamik). Norderstedt.

**Bathelt**, Harald (2001): Historische Entstehung und Standortstruktur der Chemieindustrie in Deutschland. In: Festel, Gunter/Söllner, Fritz/Bamelis, Pol (publisher): Volkswirtschaftslehre für Chemiker. Eine praxisorientierte Einführung. Berlin, Heidelberg, p. 701-713.

**Bausenwein**, Matthias/**Erett**, Anna (2009): Aufbau eines Innovationsmanagements durch die Technologieberatung UNITY. In: Fisch, Jan Hendrik/Roß, Jan-Michael (publisher): Fallstudien zum Innovationsmanagement. Methodengestütze Lösung von Problemen aus der Unternehmenspraxis. Wiesbaden, p. 53-68.

**Bea**, Franz Xaver/**Friedl**, Birgit/**Schweitzer**, Marcell (2006): Allgemeine Betriebswirtschaftslehre: Leistungsprozess. 9. , Stuttgart.

**Behr**, Arno/**Agar**, David W./**Jörissen**, Jakob (2010): Einführung in die Technische Chemie. Heidelberg.

**Bergmann**, Gustav/**Daub**, Jürgen (2006): Systemisches Innovations- und Kompetenzmanagement. Grundlagen – Prozesse – Perspektiven. Wiesbaden.

**Billing**, Fabian (2003): Koordination in radikalen Innovationsvorhaben. Wiesbaden.

**Bolz**, Alexander E. (2008): Innovation, Kooperation und Erfolg junger Technologieunternehmungen. Konzept – Panelstudie – Gestaltungsempfehlungen. Wiesbaden.

**Braunschmidt**, Inken (2005): Technologieinduzierte Innovationen: Wege des innerbetrieblichen Technologie-Transfers in innovative Anwendungen. Wiesbaden.

**Braunschweig**, Christoph/**Kindermann**, Dieter F./**Wehrlin**, Ulrich (2001): Grundlagen der Managementlehre. München.

**Büttgen**, Marion (2009): Kundenintegration in Innovationsprozesse unter Einsatz von Web 2.0-Anwendungen.

**Bundesamt für Statistik** (2009): Eidgenössische Betriebszählung 2008. Wirtschaftsstruktur: Landwirtschaft – Industrie – Dienstleistungen. Schweiz: Grossregionen – Kantone – Arbeitsstätten – Beschäftigte. Neuchâtel.

**Bundesamt für Statistik** (2010): Schweizerische Lohnstrukturerhebung 2008. Neuchâtel. Via Internet: http://www.bfs.admin.ch/bfs/portal/de/index/themen/03/22/publ.Document. 130420.pdf.

**Burr**, Wolfgang (2007): Erscheinungsformen, Bedeutung und betriebswirtschaftliche Potenziale von Dienstleistungsinnovationen.

**Busse**, Daniel (2005): Innovationsmanagement industrieller Dienstleistungen. Theoretische Grundlagen und praktische Gestaltungsmöglichkeiten. Wiesbaden.

**Chesbrough**, Henry William (2006): Open Innovation: A New Paradigm for Understandig Industrial Innovation. In: Chesbrough, Henry William/Vanhaverbeke, Wim/West, Joel (publisher): Open Innovation: Researching a New Paradigm. Oxford, New York, p. 1-14.

**Daecke**, Julia (2009): Nutzung virtueller Welten zur Kundenintegration in die Neuproduktentwicklung. Eine explorative Untersuchung am Beispiel der Automobilindustrie. Wiesbaden.

**Disselkamp**, Marcus (2005): Innovationsmanagement: Instrumente und Methoden zur Umsetzung im Unternehmen. Wiesbaden.

**Engel**, Dieter (2007): Der Kunde als Innovationspartner. Motivation, Prozesse und Erfahrungen bei der Einbindung von Kunden als aktive Partner im Innovationsmanagement der Ethicon GmbH. In: Engel, Kai/Nippa, Michael (publisher.): Innovationsmanagement: Von der Idee zum erfolgreichen Produkt. Heidelberg, p. 131-150.

**Faber**, Markus J. (2008): Open Innovation: Ansätze, Strategien und Geschäftsmodelle. Wiesbaden.

**Feldmann**, Christoph (2007): Strategisches Technologiemanagement. Eine empirische Untersuchung am Beispiel des deutschen Pharma-Marktes 1990-2010. Wiesbaden.

**Fichter**, Klaus (2005): Interpreneurship: Nachhaltigkeitsinnovationen in interaktiven Perspektiven eines vernetzenden Unternehmertums. Marburg.

**Figala**, Karin (1998): Böttger, Johann Friedrich. In: Priesner, Claus/Figala, Karin (Hrsg.): Alchemie: Lexikon einer hermetischen Wissenschaft. München, p. 85-87.

**Fischer**, Bettina (2006): Vertikale Innovationsnetzwerke. Eine theoretische und empirische Analyse. Wiesbaden.

**Flickinger**, Bernd H. (1998): Kundenorientiertes Supply Chain Management – Herausforderung und Chance im Rahmen der Globalisierung der chemischen Industrie. In: Pfohl, Hans-Christian (publisher): Kundennahe Logistik: Wertschöpfend – Agil – Beziehungsorientiert. Berlin, p. 81-105.

**Fráter**, Georg (01.06.2010): Kurze Geschichte der Schweizer chemisch-pharmazeutischen Industrie und der Schweizer Chemischen Gesellschaft. http://www.humboldt.hu/HN30/HN30-32-40-Kurze_Geschichte_der_Schweizer_chemisch-pharmazeutischen_Industrie_und_der_Schweizer_Chemischen_Gesellschaft.pdf.

**Frohwein**, Torsten (2005): Der Einfluss umweltpolitischer Regulierung auf Innovationen. In: Hansjürgens, Bernd/Nordbeck, Ralf (publisher): Chemikalienregulierung und Innovationen zum nachhaltigen Wirtschaften. Heidelberg, p. 17-43.

**Gaubinger**, Kurt (2009): Organisatorische Integration des Innovationsmanagements ins Unternehmen. In: Gaubinger, Kurt/Werani, Thomas/Rabl, Michael (Hrsg.): Praxisorientiertes Innovations- und Produktmanagement. Grundlagen und Fallstudien aus B-to-B-Märkten. Wiesbaden, p. 347-360.

**Gehring**, Petra (26.05.2010): Das Leben im Bakterium. Wenn es kein Leben ist, was ist es dann? http://www.faz.net/s/RubC3FFBF288EDC421F93E22EFA74003C4D/Doc~EAE2DA1ECEA324761A372640881C88AD9~ATpl~Ecommon~Scontent.html.

**Gelbmann**, Ulrike/**Vorbach**, Stefan (2007): Das Innovationssystem. In: Strebel, Heinz (Hrsg.): Innovations- und Technologiemanagement. Wien, p. 97-156.

**Gemünden**, Hans Georg/**Walter**, Achim (1999): Beziehungspromotoren – Schlüsselpersonen für zwischenbetriebliche Innovationsprozesse. In: Hauschildt, Jürgen/Gemünden, Hans Georg (publisher): Promotoren: Champions der Innovation p. 111-132.

**Gerstlberger**, Wolfgang/**Kreuzkamp**, Michael/**Kiesel**, Yvonne (2008): Bedeutung eines zertifizierten Managementsystems im Rahmen der MaRisk. In: Brauweiler, Hans-Christian (publisher): Unternehmensführung heute. München, p. 369-394.

**Gibson**, Daniel G./Glass, John I./Lartigue, Carole/Noskov, Vladimir N./Chuang, Ray-Yuan/Algire, Mikkel A./Benders, Gwynedd A./Montague, Michael G./Ma, Li/Moodie, Monzia M./Merryman, Chuck,/Vashee, Sanjay/Krishnakumar, Radha/Assad-Garcia, Nacyra/Andrews-Pfannkoch, Cynthia/Denisova, Evgeniya A./Young, Lei/Qi, Zhi-Qing/Segall-Shapiro, Thomas H./Calvey, Christopher H./Parmar, Prashanth P./Hutchison, Clyde A. III/Smith, Hamilton O./Venter, J. Craig (20.05.2010): Creation of a Bacterial Cell Controlled by a Chemically Synthesized Genome. http://www.sciencexpress.org / 20 May 2010 / Page 1 / 10.1126/science.1190719.

**Gleich**, Ronald/**Nestle**, Volker/**Sommer**, Luise (2009): Innovationsorientiertes Performance Measurement. Entwicklung und Implementierung einer Innovation Scorecard am Beispiel der Festo AG & Co. KG. In: Fisch, Jan Hendrik/Roß, Jan-Michael (publisher): Fallstudien zum Innovationsmanagement. Methodengestütze Lösung von Problemen aus der Unternehmenspraxis. Wiesbaden, p. 187-204.

**Gotthardt**, Cordula (2007): Innovationsmanagement in der deutschen Luftfahrtindustrie unter dem Einfluß europäischer und deutscher Innovationspolitik. Lohmar, Köln.

**Grabenströer**, Nadja (2009): Web 2.0-Potenziale im strategischen Marketing.Lohmar, Köln.

**Granig**, Peter (2007): Innovationsbewertung: Potentialprognose und -steuerung durch Ertrags- und Risikosimulation. Wiesbaden.

**Großklaus**, Rainer H. G. (2008): Neue Produkte einführen. Von der Idee zum Markterfolg. Wiesbaden.

**Hagenhoff**, Svenja (2008): Innovationsmanagement für Kooperationen. Eine intrumentenorientierte Betrachtung. Göttingen.

**Hahn**, André (2008): Social Software im Customer Relationship Management. Einsatzmöglichkeiten in der chemischen Industrie. Hamburg.

**Haid**, Philipp Emanuel (2006): Increasing Returns in the Pharmaceutical Industry through External Commercialization and the Integration of External Knowledge.

Bachelor Thesis Univerity of St. Gallen.

**Hauschildt**, Jürgen (2005a): Dimensionen der Innovation. In: Albers, Sönke/Gassmann, Oliver (publisher): Handbuch Technologie- und Innovationsmanagement. Wiesbaden, p. 23-40.

**Hauschildt**, Jürgen (2005b): Innovationsmanager als Beruf? In: Harland, Peter E./Amelingmeyer, Jenny (publisher): Technologiemanagement & Marketing. Herausforderungen eines integrierten Innovationsmanagements. Wiesbaden, p. 155-176.

**Hauschildt**, Jürgen/**Salomo**, Sören (2007): Innovationsmanagement. München.

**Heaton**, C. A. (1994): The Chemical Industry. 2nd Edition, London, Glasgow, New York, Tokyo, Mitcham, Madras.

**Helbig**, Tobias/**Mockenhaupt**, Andreas (2009): Innovationsmanagement im technischen Vertrieb. Lohmar, Köln.

**Hessenkamp**, Vanessa/**Neumann**, Debra/**Holzmüller**, Hartmut H. (2009): „Idea Fishing" an der Anbieter-Kundenschnittstelle – Konzept, Implementierung und Stolpersteine. In: Ritterskamp, Carsten/Herrmann, Thomas A./Kleinbeck, Uwe (publisher): Innovationen an der Schnittstelle zwischen technischer Dienstleistung und Kunden. 2.: Methoden und Strategien. Heidelberg, p. 19-32.

**Hübner**, Heinz (2002): Integratives Innovationsmanagement: Nachhaltigkeit als Herausforderung für ganzheitliche Erneuerungsprozesse. Berlin.

**Hungenberg**, Harald (2004): Strategisches Management in Unternehmen. Ziele – Prozesse – Verfahren.Wiesbaden.

**IKB Deutsche Industriebank AG** (2010) (publisher): Branchenbericht Chemische Industrie –April 2010. Düsseldorf.

**Kastilan**, Sonja (21.05.2010): Künstliches Leben. Vier Flaschen für ein Heureka. http://www.faz.net/s/Rub268AB64801534CF288DF93BB89F2D797/Doc~EFF7FEAF65D0D411BBCD5AE3B6A621AAE~ATpl~Ecommon~Sspezial.html.

**Koplin**, Julia (2006): Nachhaltigkeit im Beschaffungsmanagement. Ein Konzept zur Integration von Umwelt- und Sozialstandards. Wiesbaden.

**Large**, Rudolf (2009): Strategisches Beschaffungsmanagement. Eine praxisorientierte Einführung. Wiesbaden.

**Laursen**, Keld/**Salter**, Ammon (2006): Open for Innovation: The Role Of Openess In Explaining Innovation Performance Among U.K. Manufacturing Firms. In: Strateic Management Journal Volume 27/Issue 2, p. 131-150.

**Legler**, Harald (1982): Internationale Wettbewerbsfähigkeit der westdeutschen Chemischen Industrie. Berlin.

**Lettl**, Christopher (2004): Die Rolle von Anwendern bei hochgradigen Innovationen. Eine explorative Fallstudienanalyse in der Medizintechnik. Wiesbaden.

**Mast**, Claudia (2008): Unternehmenskommunikation. Ein Leitfaden. Stuttgart.

**Mensel**, Nils (2004): Organisierte Initiativen für Innovationen. Wiesbaden.

**Mirow**, Michael (2003): Wertsteigerung durch Innovation. In: Ringlstetter, Max J./Henzler, Herbert A./Mirow, Michael (publisher): Perspektiven der Strategischen Unternehmensführung: Theorien – Konzepte – Anwendungen. Wiesbaden, p. 331-346.

**Möslein**, Kathrin M./**Neyer**, Anne-Katrin (2009): Open Innovation – Grundlagen, Herausforderungen, Spannungsfelder. In: Möslein, Kathrin M./Zerfaß, Ansgar (publisher): Kommunikation als Erfolgsfaktor im Innovationsmanagement. Strategien im Zeitalter der Open Innovation. Wiesbaden, p. 85-104.

**Möslein**, Kathrin M./**Velamuri**, Vivek K. (2009): Hybrid Value Creation as Innovation Strategy. In: Fisch, Jan Hendrik/Roß, Jan-Michael (publisher): Fallstudien zum Innovationsmanagement. Methodengestütze Lösung von Problemen aus der Unternehmenspraxis. Wiesbaden, p. 485-499.

**Müller-Jung**, Joachim (21.05.2010): Durchbruch in Synthetischer Biologie. Das blaue Wunder des J. Craig Venter. http://www.faz.net/s/RubCF3AEB154CE64960822FA5429A182360/Doc~E1F1B187D18F64C5C809E1DECF1376B90~ATpl~Ecommon~Scontent.html.

**Müller-Prothmann**, Tobias/**Dörr**, Nora (2009): Innovationsmanagement. Strategien, Methoden und Werkzeuge für systematische Innovationsprozesse. München.

**Murjahn**, Ralf (2005): Kostenmanagement in der chemischen Produktentwicklung. Wiesbaden.

**Nebe**, Ralph (2007): Innovationsfreundliche Organisationsstrukturen schaffen. In: Dold, Edelbert/Gentsch, Peter (publisher): Innovation möglich machen. Handbuch für effizientes Innovationsmanagement. Düsseldorf, p. 15-58.

**O.A.** (31.08.2006): Bröckelnde Löhne für Junge und Alte. http://www.swissinfo.ch/ger/detail/index.html?cid=5418250.

**O.A.** (01.11.2006): Der rote Rhein hat sich 20 Jahre nach der Sandoz-Katastrophe erholt. http://www.chemie.de/news/d/pdf/news_chemie.de_59018.pdf.

**O.A.** (23.05.2008): Bundesratsbeschluß. Regeln für Stammzellenforschung werden gelockert. http://www.spiegel.de/politik/deutschland/0,1518,554967,00.html.

**O. A.** (15.09.2008): Chemie-Fusion. BASF bietet knapp vier Milliarden Euro für Konkurrenten. http://www.spiegel.de/wirtschaft/0,1518,578225,00.html.

**OECD** = Organisation for Economic Co-operation and Development (publisher) (2008): Open Innovation in global Networks. Paris.

**Piller**, Frank/**Reichwald**, Ralf (2007): Open Innovation – Interaktive Wertschöpfungsprozesse mit Kunden und Anwendern im Innovationsprozess. In: Streich, Deryk/Wahl, Dorothee (publisher): Innovationsfähigkeit in der modernen Arbeitswelt. Personalentwicklung – Organisationsentwicklung – Kompetenzentwicklung. Frankfurt/Main, New York, p. 175-180.

**Piller,** Frank/**Reichwald,** Ralf (2009): Wertschöpfungsprinzipien von Open Innovation – Information und Kommunikation in verteilten offenen Netzwerken. In: Möslein, Kathrin M./Zerfaß, Ansgar (publisher): Kommunikation als Erfolgsfaktor im Innovationsmanagement. Strategien im Zeitalter der Open Innovation. Wiesbaden, p. 105-120.

**Piller,** Frank/**Möslein**, Kathrin/**Reichwald,** Ralf (2009): Herausforderung für die Unternehmensführung durch Open Innovation und interaktive Wertschöpfung. In: Gelbrich, Katja/Souren, Rainer (publisher): Kundenintegration und Kundenbindung. Wie Unternehmen von ihren Kunden profitieren. Wiesbaden, p. 3-18.

**Proctor & Gamble** (10.06.2010): Innovation Strategy. http://www.scienceinthebox.com/en_UK/research/innovation-strategy_en.html.

**Reichwald**, Ralf/**Meyer**, Anton/**Engelmann**, Marc/**Walcher**, Dominik (2007): Der Kunde als Innovationspartner. Konsumenten integrieren, Flop-Raten reduzieren, Angebote verbessern. Wiesbaden.

**Reichwald**, Ralf/**Piller**, Frank (2009): Interaktive Wertschöpfung. Open Innovation, Individualisierung und neue Formen der Arbeitsteilung. 2nd edition, Wiesbaden.

**Salomo**, Sören/**Gemünden**, Hans Georg/**Billing**, Fabian (2007): Dynamisches Schnittstellenmanagement radikaler Innovationsvorhaben. In: Herstatt, Cornelius/Verworn, Birgit (publisher): Management der frühen Innovationsphasen. Grundlagen – Methoden – Neue Ansätze. Wiesbaden, p. 215-248.

**Sammerl**, Nadine (2006): Innovationsfähigkeit und nachhaltiger Wettbewerbsvorteil. Messung – Determinanten – Wirkungen. Wiesbaden.

**Seeger**, Stefan (2007): Von der Innovationsflut zum wirtschaftlichen Erfolg. Selektion, Kooperation, Organisation Innovationsmanagement in jungen, kleinen und mittleren

Unternehmen. In: Engel, Kai/Nippa, Michael (publisher): Innovationsmanagement: Von der Idee zum erfolgreichen Produkt. Heidelberg, p. 111-130.

**SGCI Chemie Pharma Schweiz** (publisher) (2010): Schweizerische chemische und pharmazeutische Industrie. Zürich.

**Spielkamp**, Alfred/**Volkmann**, Christine (2005): Führungsinstrumente im Innovationsmanagement kleiner und mittlerer Unternehmen. In: Schwarz, Erich J./Harms, Rainer (publisher): Integriertes Ideenmanagement. Betriebliches und überbetriebliches Ideenmanagement unter besonderer Berücksichtigung kleiner Unternehmen. Wiesbaden, .p. 267-290.

**Stahlschmidt,** Rainer (1977): Quellen und Fragestellungen einer deutschen Technikgeschichte des frühen 20. Jahrhunderts bis 1945. Göttingen.

**Statistisches Bundesamt** (20.07.2010): Bruttoverdienste. 1. Quartal 2010: Reallöhne steigen um 0,8%. http://www.destatis.de/jetspeed/portal/cms/Sites/destatis/Internet/DE/Content/Statistiken/VerdiensteArbeitskosten/Bruttoverdienste/Aktuell,templateId=renderPrint.psml.

**Stern,** Thomas/**Jaberg,** Helmut (2005): Erfolgreiches Innovationsmanagement. Erfolgsfaktoren – Grundmuster – Fallbeispiele. Wiesbaden.

**Tintelnot**, Claus (1999): Einführung in das Innovationsmanagement. In: Tintelnot, Claus/Meißner, Dirk/Steinmeier, Ina (publisher): Innovationsmanagement. Berlin p. 1-12.

**VCI = Verband der Chemischen Industrie e.V.** (publisher) (2007): Die chemische Industrie in Deutschland – Stand August 2007. http://www.vci.de/template_downloads/tmp_VCIInternet/65348Branche%20082007.pdf?DokNr=65348&p=101.

**VCI = Verband der Chemischen Industrie e.V.** (publisher) (2009): Chemiewirtschaft in Zahlen 2009. Frankfurt/Main.

**VCI = Verband der Chemischen Industrie e.V.** (publisher) (25.05.2010): Fakten und Standpunkte – Juni 2009. http://www.vci.de/default~cmd~shd~docnr~94490~lastDokNr~~1.htm.

**Verbeck**, Alexander (2001): Kooperative Innovation: Effizienzsteigerung durch Team-Management. Zürich.

**Wahren**, Heinz-Kurt (2004): Erfolgsfaktor Innovation: Ideen systematisch generieren, bewerten und umsetzen. Berlin, Heidelberg.

**Weber**, Christiana (2007): Wissenswerte durch Unternehmensnetzwerke. Eine multiperspektivische Analyse am Beispiel von Corporate Venture Capital. Wiesbaden.

**Wentz**, Rolf-Christian (2008): Die Innovationsmaschine: Wie die weltbesten Unternehmen Innovationen managen. Berlin, Heidelberg.

**Wit**, Jan de/**Dankbaar**, Ben/**Vissers**, Geert (2007): Open Innovation: the New Way of Knowledge Transfer? In: Journal of Business Chemistry (Volume 4/Issue 1 (January 2007)), p. 11-19.

**Wördenweber**, Burkard/**Wickord**, Wiro (2004): Technologie- und Innovationsmanagement im Unternehmen. Lean Innovation. Berlin, Heidelberg, New York, Hongkong, London, Mailand, Paris, Tokio.

**Zedelius**, Werner (2007): Innovation bei der Allianz. In: Schmidt, Klaus/Gleich, Roland/Richter, Ansgar (publisher): Innovationsmanagement in der Serviceindustrie. Grundlagen, Praxisbeispiele und Perspektiven. Freiburg im Breisgau, p. 225-240.

**Zeder**, Melanie (2009): Crowdsourcing – Open Innovation in der schweizerischen Pharmabranche unter besonderer Berücksichtigung von Crowdsourcing. Master Thesis. University of St. Gallen.

**ZEW** (= Zentrum für europäische Wirtschaftsforschung)/**NIW** (= Niedersächsisches Institut für Wirtschaftsforschung) (publisher) (2009): Innovationsmotor Chemie 2009. Mannheim.